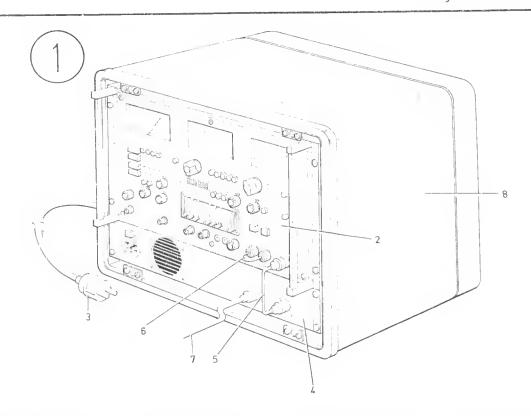
Utgåva 3 Sida 1



| Pos | Ant   | Förrådsbeteckning | Förrådsbenämning    | Ursprungsbenämning                | Ursprungsbeteckning   |
|-----|-------|-------------------|---------------------|-----------------------------------|-----------------------|
| 1   |       | M3743-558011      | Radioprovare 558 MT |                                   |                       |
| 2   | 1     | M3743-558010      | .Radioprovare 558   | Stabilock Funkgeräte<br>Messplatz | SCHIN-STABILOCK 4011S |
|     | 1     | M3743-558109      | Beskrivning handhav |                                   |                       |
|     | 1     | M3743-558119      | Beskrivning service |                                   |                       |
| ذ   | 1     | M1812-127020      | Nätkabel            |                                   |                       |
| Til | lbehö | ör:               |                     |                                   |                       |
| 4   | 1     | M3437-558149      | .Högeffektdämpare   |                                   | SCHIN-40110           |
| 5.  | 1     | M3743-558169      | .övergångsbygel     |                                   | SCHIN-380398          |
| 6   | 1     | M3743-558159      | .övergångsbygel     |                                   | SCHIN-380615          |
| 7   | 1     | M3743-558189      | .Mätkabel           |                                   |                       |
| 8   | 1     | M3743-558199      | .Transportlåda      |                                   | SCHIN-770060          |

Utgåva 3 Sida 2

#### DA TA

Stördeviation:

CCITT-filter:

Mottagarmätningar 0.01...479,9999 MHz Frekvensområde: Frekvensinställning: Digital  $1 \times 10^{-7}$  efter 10 min vid  $20^{\circ}$ C Frekvensonoggrannhet:  $1 \times 10^{-8}/24t$  efter 8 veckor uppv Frekvensdrift: 0,025 uV...19 mV EMK Utspänning: Direktutgång 0,5 uV...380 mV EMK 50 ohm Impedans: 0,3/0, 4/1/2,7/3/4,8 och LF- rscillator: 0,03...10 kHz 0...100 % Amplitudmodulering: 0...20 kHz Frekvensmodulering: Fasmodulering: 0...5 rad L¹ oltmeter: 0...30 V 30 Hz...20 kHz Frekvensområde;  $\pm$  (5 % + 1,5 % av fsk) vid 1 kHz Mätonoggrannhet: Distorsionmeter: Frekvens: 1 kHz ± 1 % 0...20 % Mätområde: 10 mV...30 V Inspänning:  $\pm$  (12 % + 1,5 % av fsk) + egendis. Mät.onoggrannhet: Egendistorsion: < 0,5 % SINAD-meter: 1 kHz + 1 % Frekvens: 6,12 och 20 dB markeringar Mätområde: 10 mV...30 V Inspänning: 6 dB: ± 1 dB, 12 dB: ± 2 dB, 20 dB: ± 3 dB Matonoggrannhet Inkopplingsbart vid deviations- eller LF-mätning CCITT-filter: Sändarmätningar E ktmeter: 1,5...480 MHz Frekvensområde: 0,2...100 W Mätområde:  $\pm$  (7 % + 0,5 % av fsk) 4...200 MHz. Frekvensgång <  $\pm$  3 % inom 1,5...480 Mätonoggrannhet: inom 1,5...480 MHz M .leringsmeter AM: 30 Hz...10 kHz Moduteringsfrekvens: 0...100 % Mätområde: Mätosäkerhet:  $\pm$  (5 % + 1,5 % av fsk) vid 1 kHz (även fasmodulering 0...5 rad) Moduleringsmeter FM: 20...479,9999 MHz Frekvensområde: 0...20 kHz Deviation: 30 Hz...20 kHz Moduleringsfrekvens:  $\pm$  (3 % + 1,5 % av fsk) vid 1 kHz Mätosäkerhet: < 9 Hz (CCITT)

Inkopplingsbart vid deviations- eller LF-mätning

Utgåva 3 Sida 3

DATA

Övrigt

Strömförsörjning:

Nät

220 V -15...+ 10 %. 50 VA

Yttre batteri + 12 V/ca 4,5 A

I drift: + 5...+ 40" C

Dimensioner:

534 x 450 x 460 mm (inkl militär låda)

Vikt:

31 kg

# SERVICE INSTRUCTIONS STAGE LOCATIONS

1. Immediate access is provided to the following stages subsequent to screwing off the covers without any further disassembly (figs. 1 and 2, page 4/8):

Oscillator Stage 213 016 / 213 017 l.h. instrument side

Decade Stage 211 021 instrument top

Output Stage 230 025 r.h. instrument side

Supplementary Oscillator

Stage on 4011 213 014 instrument bottom

A 6 mm Allen key is required to open up these stages.

2. The Power Supply 204 022 is located directly on the inside of the instrument rear panel (fig. 3).

Use test points recommended in fig. 3 for checking supply voltages. These test points as well as the fuse for the power supply of the Channel Selector Type 4932 are accessible subsequent to removal of the instrument bottom cover. To facilitate repair work on the Power Supply the instrument rear panel can be hinged open after having removed the 4 Phillips head screws connecting the bottom and top frame.

Should the Power Supply need to be operated in the hinged open position the connector St 8 (to mains switch fig. 3) must be disconnected and a two pole short-circuiting link (HNK 898 030) used instead of the mains switch.

3. The Control and Display Unit 209 021 contains the following assemblies apart from the control and display components (see fig. 4):

Modulation Selector Board 361 088
AF Unit Board 361 154

Receiver/Transmitter

Test Changeover Board 361 086

Frequency Counter Circuit diagram 237 002

Modulation Generator Circuit diagram 208 025/026

Diode Probe Circuit diagram 229 006

All calibrating controls of Boards 361 088 and 361 154 are accessible from above after removing the outer covers with the aid of a long calibrating screwdriver.

4020 series SV 1/8

The location of the calibrating controls is shown in fig. 5, the arrangement of the calibrating components of all other stages being indicated in the corresponding chapters. The Control and Display Unit can be separated from the rear instrument unit to carry out major repairs on the AF Unit or on the Modulation Selector which is, however, not necessary for repairs to be carried out on the Modulation Generator, Frequency Counter and Diode Probe.

Instructions for removing the Control and Display Unit from the rear instrument section (see fig. 6):

- 1) Remove all four cover sheets
- Screw off adjustment knob for step attenuator
- 3) Loosen jack 22 (see fig. 4) after having removed the lock screw on the jack.
- 4) Disconnect plugs St 20 and St 32 (fig. 4)
- 5 Disconnect jack Bu 8 (see also fig. 3)
- 6 Disconnect two cable clamps
- Disconnect cable from jack Bu 13
- Remove 4 x 2 slotted head screws on case frame
- 9) Pull two instrument halves apart
- 4. Modulation Generator 208 025/026 (fig. 4)

All calibrating controls are accessible from the bottom of the instrument after having removed the floor cover. For location of calibrating components see drawing 361 087 chapter 4. To remove the modulation generator take off front panel by removing six Phillips head screws and pulling off all control knobs. After having removed the 3 central mounting nuts on the controls of the modulation generator the latter can be removed from the rear.

5. Should the <u>Frequency Counter</u> 237 002 (fig. 4) need to be removed for instrument repairs, front panel must also be removed (see instructions for 4. above).

Three screws remain to be loosened after having removed a spacing piece to the printed circuit board 361 154 located above, the three screws being necessary to mount the counter to the assembly plate. Depending on the serial number of the instrument these screws are accessible either from the front or rear of the assembly plate. In the latter instance disassembly of the counter is considerably facilitated when the rear panel of the instrument (power supply) is previously removed (necessitating removal of 8 screws).

4020 series SV 2/8

## 6. Diode Probe 229 006 (fig. 1)

Remove by screwing off front panel (see 4) and loosening the two assembly plate screws together with a further screw connecting the bottom frame having previously screwed off plug St 12.

## 7. Crystal Stage 214 022 (fig. 3)

The crystal stage can be removed from underneath after having loosened the 4 Phillips head screws in the instrument rear panel.

## 8. 10 x 10 dB Step Attenuator 370 014 (fig. 3)

To remove the step attenuator take off the rear panel (necessitating removal of 8 Phillips head screws connecting bottom and top frame) and then remove adjustment knob and screening can (2 or 3 slotted head screws).

The step attenuator can then be removed after having disconnected the cable connections.

4020 series SV 3/8

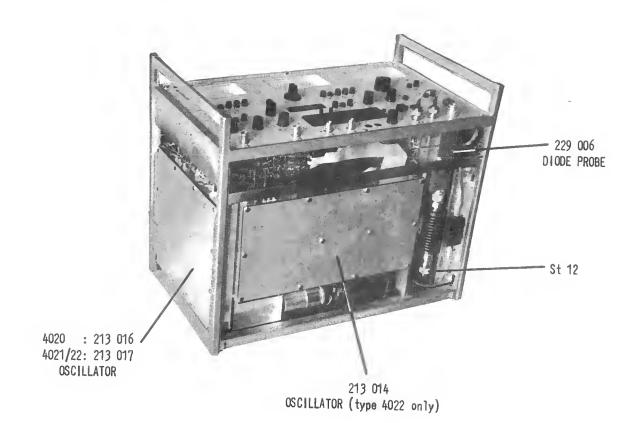


FIG. 1

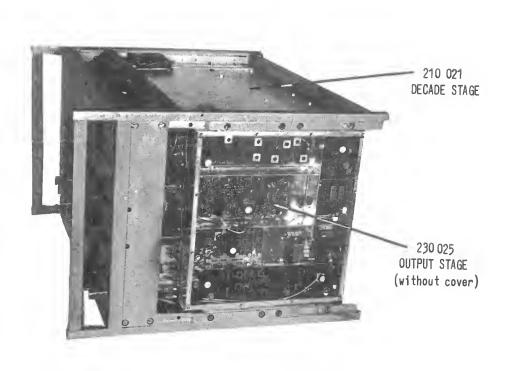
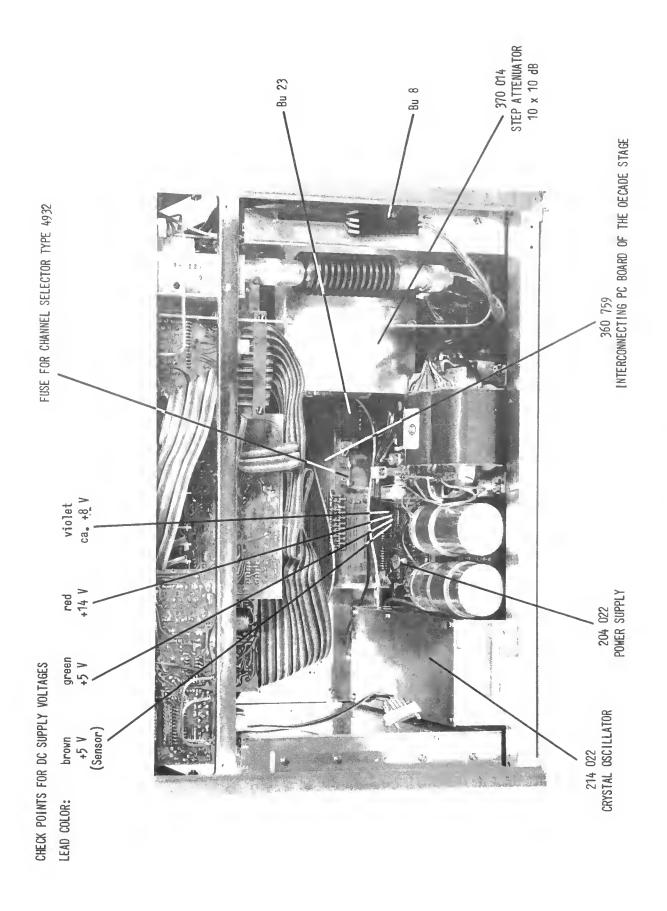


FIG. 2



4020 series SV 5/8

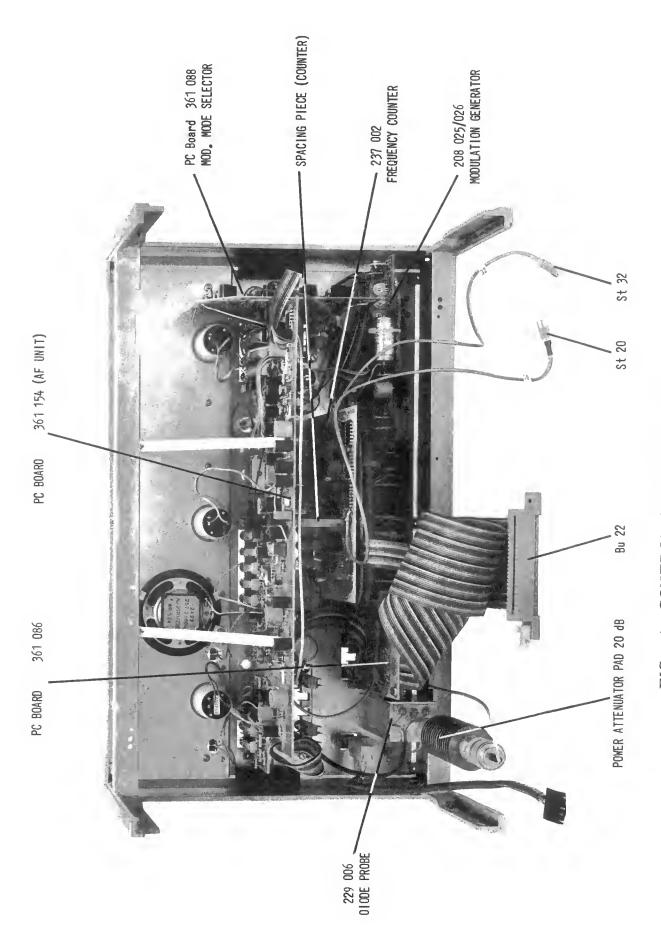
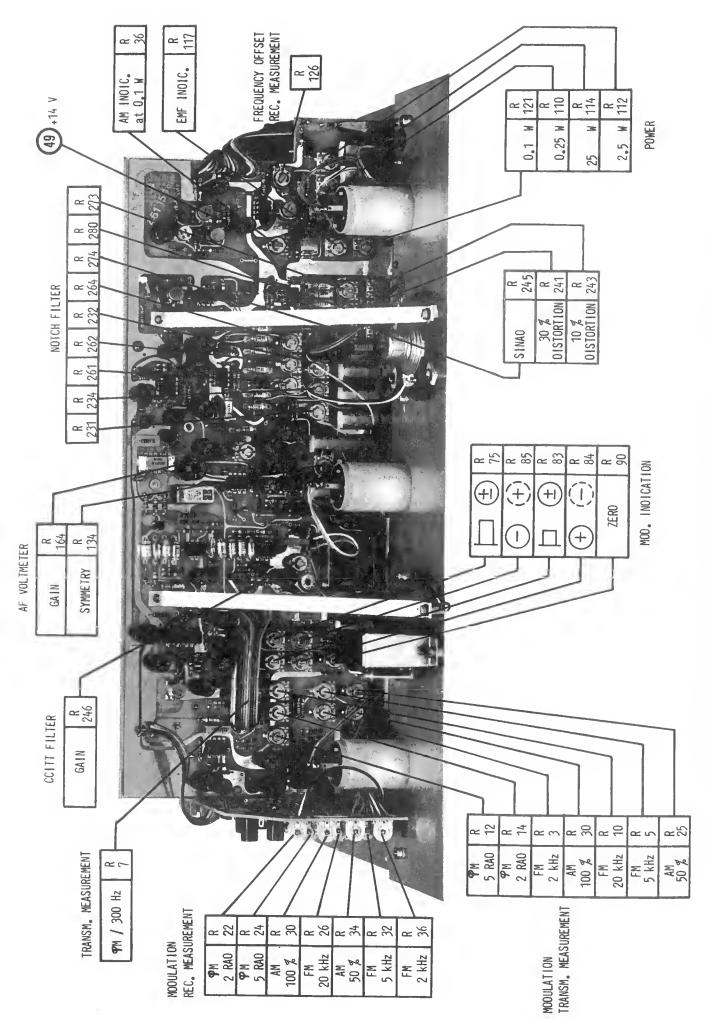


FIG. 4: CONTROL AND DISPLAY UNIT



ADJUSTMENT LOCATIONS OF THE CONTROL AND DISPLAY UNIT 5: FIG.

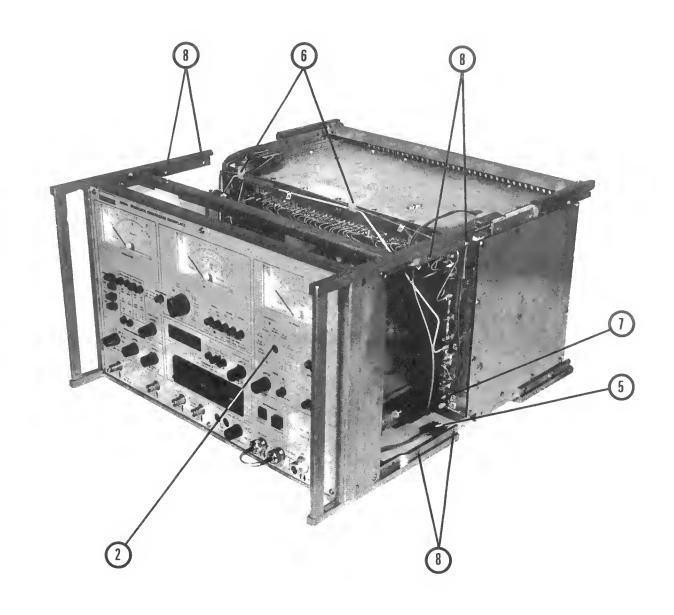
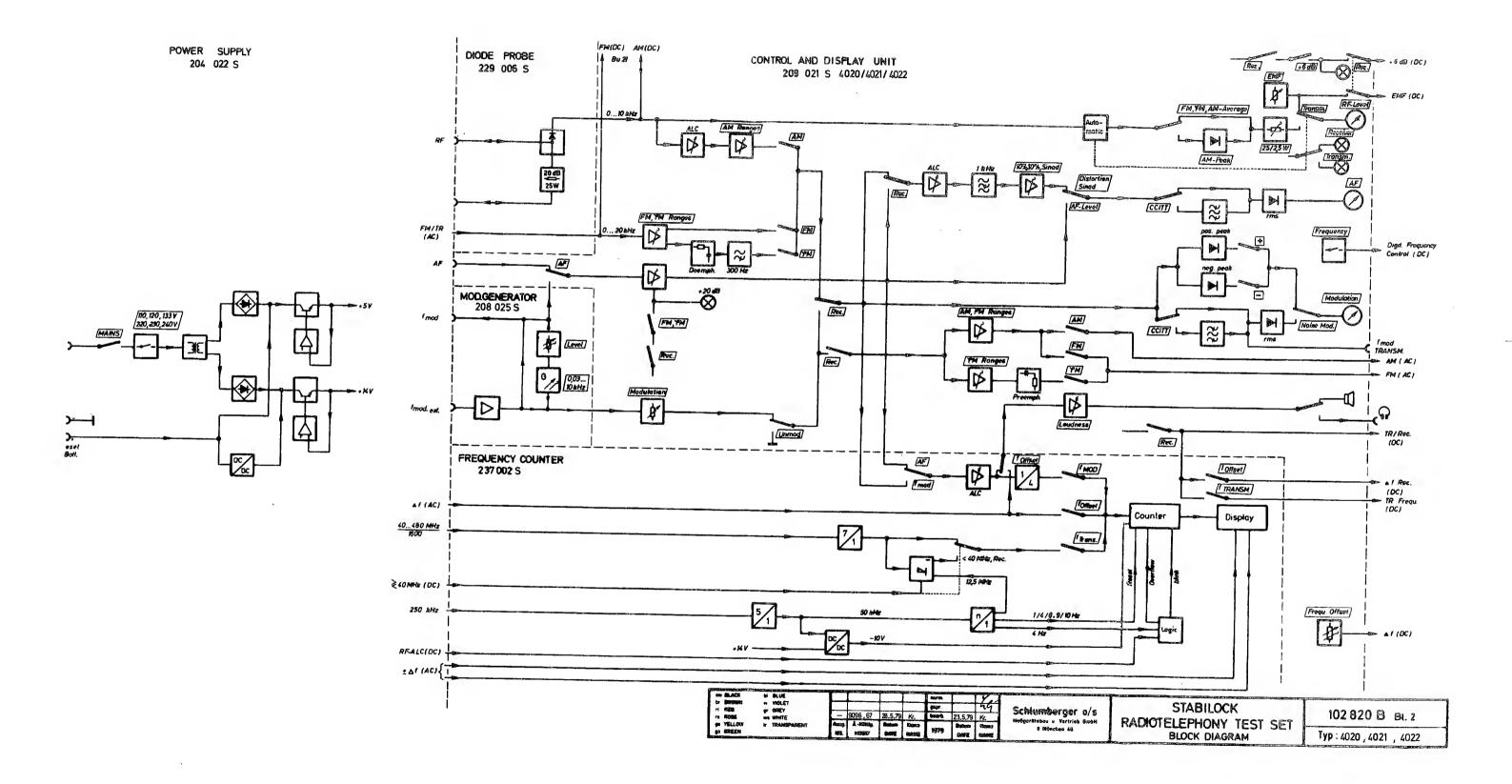
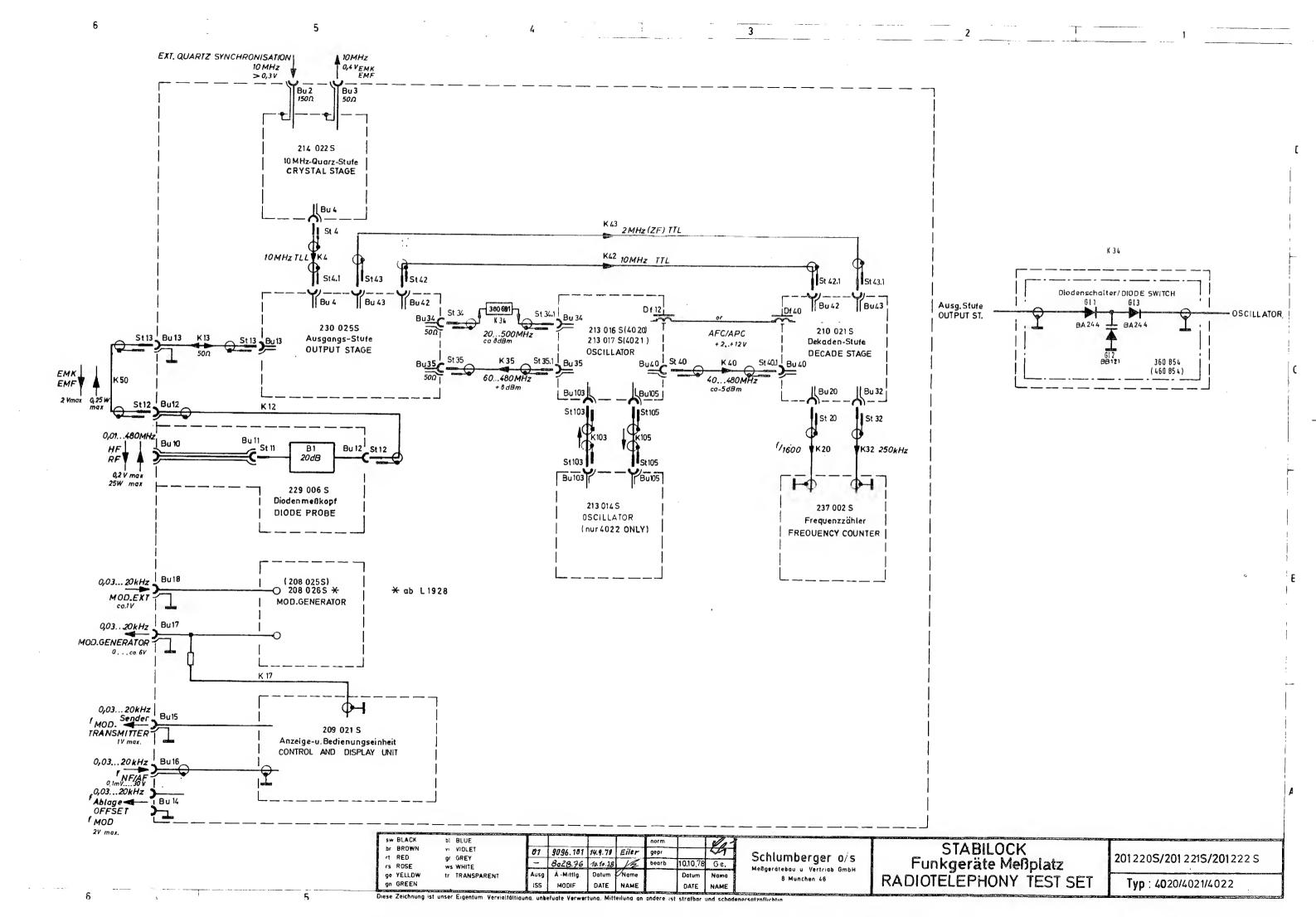


FIG. 6: REMOVING THE CONTROL AND DISPLAY UNIT





(See block circuit diagram 102 820 B for total instrument)

#### 1. RF Level

On <u>receiver measurements</u> the potentiometer voltage required for vernier adjustment of the EMF is indicated on the meter, the signal light (see also output stage) lighting up when the level is increased by +6 dB.

On <u>transmitter measurements</u> the DC provided by the diode probe is provided directly to the meter through the range selector (25 W/ 2,5 W). Peak rectification is included only when indicating AM peak power. The switch-over to transmitter measurement mode can also be performed automatically, when the transmitter exceedes 50 mW.

In <u>duplex operation</u> the EMF adjustment and all other functions of the instrument are the same as for receiver measurements with the exception that the power indication corresponds to that of transmitter measurement. The signal lamp for transmitter measurement is lighting.

#### 2. Modulation

On receiver measurements the AF provided by the modulation generator is provided for the meter indication to a positive or negative peak rectifier through the continuous modulation adjustment. This AF is also provided through various range and type modulation switches to the AM modulator in the output stage "AM(AC)" or to the FM modulator in the oscillator stage "FM(AC)". On phase modulation the amplitude of the low frequencies is reduced by 6 dB per octave in the preamphasis circuit.

On transmitter measurements the AF signal provided by the demodulators (see also probe or output stage) is passed through various range and modulation type selectors and rectified and indicated as for receiver measurements. In addition, use can also be made of a more sensitive interference modulation indication with RMS rectifier and CCIT weighting filter (see operating instructions 4.15). Two special circuit arrangements require particular mention:

|              | Function | Description | 209 021 F                | Sheet 1/2 |
|--------------|----------|-------------|--------------------------|-----------|
| Schlumberger | Type:    | 4020/21/22  | Control and Display Unit | Date 0979 |

## a) Automatic level control (ALC) on AM

The mean DC provided at the output of the diode probe is used to control the intensity of a luminous diode in an optocoupler and thus the resistance of a photo resistor in the LF input attenuator. This control maintains the mean DC output constant despite fluctuations of the input level thus ensuring that the LF amplitude is directly proportional to the AM depth of modulation.

## b) $\phi M$ -deemphasis and 300 Hz high pass filter

Contrary to the preemphasis circuit the amplitude of low frequencies is increased by 6 dB per octave in the deemphasis circuit. An active 300 Hz high pass filter eliminates any disturbances due to the frequencies elevated <300 Hz.

#### 3. Distorsion Meter

The distorsion meter is provided with the demodulation signal on transmitter measurements or the AF voltmeter signal on receiver measurements, the output amplitude being maintained constant in an ALC circuit (same as on AM measurements) employing an optocoupler and LF rectifier. Due to the selective suppression of the 1 kHz fundamental in the following, 3-stage 1 kHz band stop filter (active notch filter) merely the distorsion and noise components remain which subsequent to range switching and RMS rectification are indicated directly as distorsion or SINAD ratio. The insertable CCITT filter is explained in detail in the operating manual (4.15).

#### 4. AF Voltmeter

The AF voltmeter operates together with the range switches and operation amplifiers in the usual way, the meter indication comprising elements of the distorsion meter such as CCITT filter and rectifier.

Sensitivity is automatically 20 dB down on receiver measurements and  $\phi M/FM$  modulation.

## 5. Digital Frequency Adjustment

The decade stage is introduced to the positions of the decade switches. On REMOTE CONTROL mode the frequency must be set to 600 MHz (see operating manual 3.7).

|              | Function | n Description | 209 021 F                | Sheet 2/2 |
|--------------|----------|---------------|--------------------------|-----------|
| Schlumberger | Type:    | 4020/21/22    | Control and Display Unit | Date 0979 |

|   | MEASURED<br>VALUE          | yo   | ۸۰۰۰۰                                | Λ                      |                           | ok  |               |
|---|----------------------------|--|--------------------------------------|------------------------|---------------------------|---|---------------|
|   | REQUIRED VALUE             |  | v 13,95 14,05 V                      | V 4,95 5,05 V          |                           | Approx. same brightness, appropriate to depressed push buttons  |               |
|   | ADJUST                     |  |                                      |                        |                           |   |               |
|   | FREQUENCY                  |  | 8                                    | 2 2                    |                           |   |               |
|   | MEASURE                    |  | (6) (4) Counter                      | . 8u 45/11<br>8u 45/ 4 |                           | NT)   |               |
|   | PROCEDURE                  | The Control and Display Unit must be connected to the other units of the instrument.  Modulation Generator (208 025/26), Diode Probe (229 096) and Frequency Counter (237 002) must be completely adjusted (see concerning chapters) and mounted to the Control and Display Unit.  For fault locations, it can be useful, to place the electrically connected Counter outside of the instrument.  Check mechanical zero deflection of the indicating instruments I1 (MODULATION), I 2 (AF) and I 3 (RF-LEVEL). | 1. Rail Voltages 209 021 S Bl. 2 + 3 |                        | 2. Signal Lamps Lamp Lamp | RECEIVER RM ( = RECEIVER MEASUREMENT)  TRANSMITTER TM ( = TRANSMITTER MEASUREMENT)  RM + TM  + 6 dB + 6 dB + RM  +20 dB RM + FM / PM + VOLTMETER  Dist, 10%, 30%, SINAD |               |
|   | REQUIRED TEST<br>EQUIPMENT | MAG  |                                      |                        |                           |   |               |
|   |                            | Adjustment and Test F  | <del></del>                          | Name                   | T                         | 4020 se<br>Control and disp   |               |
| 1 | Schl                       | 02 0028, 29<br>01 9028, 32   |                                      | Morasch                | nj                        | 209 021 A   | 1/12<br>Sheet |

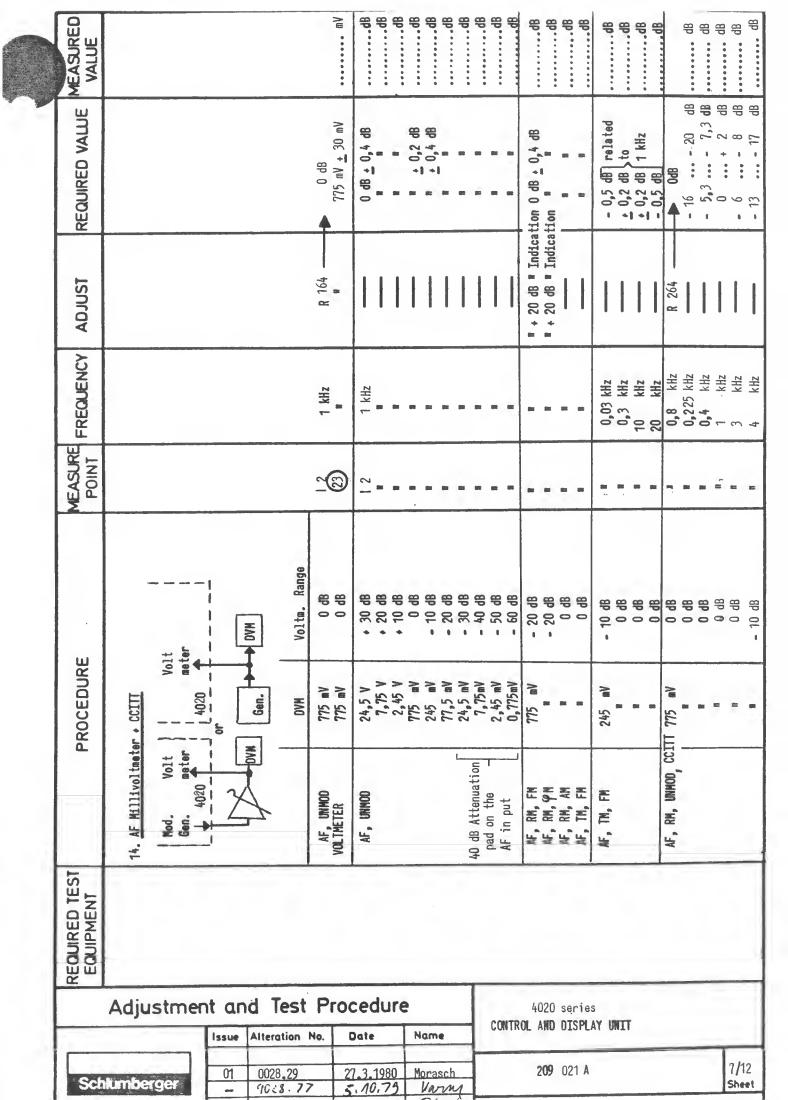
| MEASURED<br>VALUE          | 0k   |   | , o   | , ok                                | *0ok   |            |
|----------------------------|--|---|---|-------------------------------------|--|------------|
| REQUIRED VALUE             | blinking   | correct frequency   | Counter displays offset frequency to 10 MHz   | DC level between pins 47 and 49 0 V | , 5 v<br>0 v<br>0 v<br>0 v<br>0 v<br>0 v<br>0 v<br>0 v<br>0 v  |            |
| ADJUST                     |  |   |   |                                     |  |            |
| FREQUENCY                  |  | 0,1 479,9<br>MHz  | + 0+99,9<br>kHz   | ro]<br>DC                           |  |            |
| MEASURE                    | Display  | •   |   | Remote control socket on rear panel | Bu 22 pin 14  " " " pin 15  " " " pin 21 pin 22  |            |
| PROCEDURE                  | 3. Countor Display Decade switch 600 MHz f OFFSET Knob FREQUENCY OFFSET depressed F FREQUENCY OFFSET depressed | 4. Frequency Setting Push buttons RM and fTRANSM, pressed Check 100 kHz to 100 MHz Decade 0, 1, 2,9, (within specified 4020 frequency ranges) | Connect 10 MHz output on rear panel to RF DIRECT socket on front panel.  Depress TM * forFSET push buttons Check 10,0000 to 10,0999 | Decade switch to 900 (> 800) MHz    | 5. Control Lines to RF Section Only for fault locations Depressed push buttons IM RM TM / + 6 dB RM TM / TRANSM. RM / fOFFSET TM / R |            |
| REQUIRED TEST<br>EQUIPMENT |  |   |   |                                     |  |            |
|                            | Adjustme   | nt and Test   |   |                                     | 4020 series<br>CONTROL AND DISPLAY UNIT  |            |
| Sch                        | iumberger  | 1ssue   Alteration  | 27.3.1980   |                                     | 209 021 A 2/<br>She  | /12<br>ret |

| MEASURED<br>VALUE          |   | Åo   | 0k  |      | , o  | tion                   |               |
|----------------------------|---|--|---|------|--|------------------------|---------------|
| REQUIRED VALUE             | <pre></pre>   | + 9,6 +10,5 V<br>+ 1,7 + 2,2 V<br>+ 9,50 ± 0,01 V<br>full scale deflection<br>\$ 19 mV EMF | + 10,7 V ( = .7.3,7)<br>+ 3,3 V (= .7-3,7)<br>+ 6,85V (= .7-0,15)<br>+ 7,15V (= .7.0,15)  |      | $\begin{bmatrix} I_1 & 0 & V \\ I_1 & 0 \end{bmatrix} \text{ alternating }$ $\begin{bmatrix} I_1 & 0 \\ 1 & 1 \end{bmatrix} \times 1 \text{ mV}$ | Ifull scale deflection |               |
| ADJUST                     |   | ENF Control Knob on front panel: 3 fully clockvise 3 fully anti-clockv. set to and R 117   | R 126   |      | R 7 ("Modulation")   | R 85<br>R 84<br>R 75   |               |
| FREQUENCY                  | 요   | DC   | 8   |      | AC<br>DC<br>" T kHz  |                        |               |
| MEASURE                    | 40 PCB 088<br>3 PCB 088<br>K25/R171   | Bu 22/15   | Bu 22/7   |      | ⊕r_ = ⊕  | H                      |               |
| PROCEDURE                  | 6. Control Lines within the Control and Display Unit Depressed push buttons: RM TM / fTRANSM. | 7. EMF Indicating Instrument push button RM depressed                                      | 8.FREQUENCY OFFSET Control on REC. MEASUREMENT (Potentiometer R 5 on front panel) R 5 fully clockwise, pulled " fully anti-clockwise, pressed " fully anti-clockwise, pressed " fully anti-clockwise, pressed | 0    | push button RM, UNNOD, (+), 20 kHz depressed  " " " " " " " " " " " " " " " " " " "  | push button RM, FM,    |               |
| REQUIRED TEST<br>EQUIPMENT |   |  | ;   |      |  |                        |               |
|                            | Adjustmen   | and Test Pr  |   | CONT | 4020 series<br>ROL AND DISPLAY UNIT  |                        |               |
| CAL                        | lumberger   | 02 0028.29<br>01 9028:25   | 27.3.1980 Marasch<br>5:10.73 Yavry  |      | 209 021 A  |                        | 3/12<br>Sheet |

| MEASURED<br>VALUE          |  |  | , ok        |   | 2, V<br>2, V<br>2, V                              |            | Value   | 2, 7                       | 2, V<br>2, V   |  | 2,  | 2,  |
|----------------------------|--|--|-------------|---|---|------------|---|----------------------------|--|--|---|---|
| REQUIRED VALUE             | 3 V → 20 mV  | 750 mV + 4 mV<br>300 mV + 2 mV<br>750 mV + 4 mV<br>300 mV + 2 mV | 20          |   | 2,35 2,45 V<br>as on 1 kHz ± 0,1 V<br>" " ± 0,1 V |            | 133 137 mV<br>445 455 mV                              |                            | 8 8 8 0,1 V  | reading 16 kHz                           | 2,352,45 V<br>as on 1 kHz ± 0,2 V             | 0,1 V V V V V V V V V V V V V V V V V V V |
| ADJUST                     |  | R 35<br>R 36<br>R 24   | R 34        |   |   |            |   |                            |  | 1  |   | 111                                       |
| FREQUENCY                  | 1 kHz  |  |             |   | 1 KHz<br>50 Hz<br>10 KHz                          |            | 0,3 kHz<br>1 kHz<br>6 vHz                             | -20                        | 300 H <sub>2</sub><br>10 kH <sub>2</sub><br>20 kH <sub>2</sub> | 1 kHz                                    | 1 kHz<br>50 Hz                                | 300 Hz<br>10 kHz<br>20 kHz                |
| MEASURE                    | (5)<br>Bu 22/8   |  | Bu 22/11    | Output stage<br>St 49/pin 5<br>or                       | Bu 22/11  | Oscillator | or 8u 22/8  |                            |  | =  |   |   |
| PROCEDURE                  | 10. RM Modulation Ranges Modulation generator 1 kHz push button RM, FM, 20 kHz | 8 8 9 KHz 8 8 9 KHz 8 8 9 W, 5 Rad                               | " AM, 100 % | 11. RM Modulation Frequency Response 4020 Settings (RM) | AN, m = 80 % (I <sub>1</sub> ), f = 1 kHz  "      |            | QM, 3 Rad (I <sub>1</sub> ), f = 0,3 kHz  # f = 1 kHz | 16 kHz (I <sub>1</sub> ),f | # # # f = 300 Hz   | AF - Gemerator appr. 0.8 V on EXT Input: | FM, Dav, = 16 kHz (I <sub>1</sub> ),f = 1 kHz | # # # # # # # # # # # # # # # # # # #     |
| REQUIRED TEST<br>EQUIPMENT |  |  |             |   |   |            |   |                            |  | AF - Generator                           |   |   |
|                            | Adjustme   |  | Test F      | Procedu   | re<br>Name  |            | C   |                            | 020 serie:<br>AND DISPL  |  |   |   |
| Sch                        | lumberger  | 01 0   | 028.29      | 27.3.1980   | Morasc  |            | Replacem  |                            | 021 A  |  |   | 4/1<br>Shee                               |

| ALUE WEASURED              |  | lection<br>lection  |   | Rad<br>Rad<br>Rad                                  |   |
|----------------------------|--|---|---|--|---|
| REQUIRED VALUE             |  | full scale deflection full scale deflection   | full scale deflection full scale deflection | 4,8 5,2 Rad<br>4,9 5 Rad<br>4,9 5 Rad<br>4,8 5 Rad |   |
| ADJUST                     |  | R R 3   | R 12  | R 7  |   |
| FREQUENCY                  |  |   |   | 0,3 KHz 0,4 KHz 3 KHz 10 KHz                       |   |
| MEASURE                    |  | 22/2<br>I   |   |  | •                                       |
| URE                        | TM Modulation Ranges Disconnect the FM/TR(AC) signal from the Output Stage (230 025 S Bl. 1/green wire DF 8 St 49/5) and replace it by the output signal of the Mod. Generator | 4020-push buttons actuated Level on St 59/pin 5 or Bu 22/2 FN, 20 kHz, (+)(-) 1 V 250 mV 250 mV | 250 mV<br>100 mV                            | 75 mV<br>100 mV<br>250 mV<br>750 mV<br>2,5 V       |   |
| PROCEDURE                  | 12. TM Modulation Ranges Disconnect the FM/TR(AC) (230 025 S Bl. 1/green vireplace it by the output  | FN, 20 kHz, (-) (-)   | go N, 5 Raid ⊕ ⊕                            | φM 5 Rad   |   |
| REQUIRED TEST<br>EQUIPMENT |  |   |   |  |   |
|                            | Adjustmer  | nt and Tes  |   |  | 4020 series<br>CONTROL AND DISPLAY UNIT |
| Sch                        | llumberger   | 01 0028.20  | 27.3.                                       |  | 209 021 A                               |

| URED                       |                                      | <u>-</u>  | kHz                   | khz        | 7.17       | ok .             |                   |               |               |           | * *       |        |       |  |               |  |       |    |             |
|----------------------------|--------------------------------------|---|-----------------------|------------|------------|------------------|-------------------|---------------|---------------|-----------|-----------|--------|-------|--|---------------|--|-------|----|-------------|
| MEASURED<br>VALUE          |                                      |   |                       | •          |            | •                |                   |               |               |           | yo        |        |       |  |               |  |       |    |             |
| REQUIRED VALUE             |                                      |   | 2 kHz                 | 1.85 2 kHz | 1.85 2 kHz | 1 V ± 10 mV      | 4.8 5.2 Rad       |               | 4.9 5 Rad     | 4.9 5 Rad | 4.8 5 Rad |        |       |  |               |  |       |    |             |
| ADJUST                     |                                      |   |                       |            | 1          | 1                | R 24              |               |               |           |           |        |       |  |               |  |       |    |             |
| FREQUENCY                  |                                      |   | 1 kHz                 | 20 kHz     | 30 kHz     | 1 kHz            | 0.3 kHz ]         | 0.4 kHz       | 1 kHz         | 3 kHz     | 10 kHz    |        |       |  |               |  |       |    |             |
| MEASURE                    |                                      |   | <del>-</del>          | =          | =          | Bu 15            | _                 | =             | 8             |           | 8         |        |       |  |               |  |       |    |             |
| PROCEDURE                  | 13. IM Modulation Frequency Response | . 4020 Settings (TM) AF Generator level on St 59/5 or Bu 22/2 | FM, Af 2 kHz ⊕ 100 av | EW as O    |            | 3 20 kHz (→) 1 V | φM 5 Rad ⊕⊙ 75 mV | m m ⊕_ 100 mV | n n ⊕_ 250 nV | n n ⊕     | n         |        |       |  |               |  |       |    |             |
| REQUIRED TEST<br>EQUIPMENT |                                      | Millivoltmeter<br>Af Generator                                |                       |            |            |                  |                   |               |               |           |           |        |       |  |               |  |       |    |             |
|                            | Adj                                  | ustn  | ner                   |            | _          |                  |                   | _             |               |           | _         |        |       |  | 4020<br>ROLAN |  | Y UNI | ΙT |             |
| Sch                        | nlumb                                | erger   |                       | 01         |            | 0028             | 29                |               | 27.3.         | .1980     | D N       | orasch | Pasta |  | 29 02         |  |       |    | <br>6<br>Si |



| MEASURED<br>VALUE          | 9  | , <b>Q</b>                               | Λ                                |                      |   | \mu                                     |  | , O.   | - dBm<br>- dBm  | ok   |                                |
|----------------------------|--|--|----------------------------------|----------------------|---|---|--|--|---|--|--------------------------------|
| REQUIRED VALUE             | 8b 09 〈  | 0 dB<br>7 40 dB                          | 0.9 1 V                          |                      | ion   | 690 810 mV<br><b>△</b> V <b>△</b> 10 mV | + 10 dBm Indication                    | - 75 d8m   | < - 40 dBm<br>< - 55 dBm<br>clear to recognize:<br>3 poles at<br>985/1000/1010 Hz | 25 %<br>- 12 dB                                    | < 0,6 %                        |
| ADJUST                     | R 134  | R 164                                    | (0+ 0)                           | 0 96 136 180         | R 231, 232, 234, R 273, 274, 280 preset to mid-position                                   |   | Adjust sensitivity of analyser to      | R 261, 264, 262,—<br>R 231, 232, 234,—<br>R 273, 274, 280  |   | R 241<br>R 245<br>R 243                            |                                |
| FREQUENCY                  | 1 kHz  | 1 kHz<br>20 kHz<br>50 kHz                | 1 kHz                            |                      |   | 1 kHz                                   | 6 kHz                                  | 1000 ± 1 Hz<br>985 ± 1 Hz<br>1010 ± 1 Hz   | 9751015 Hz<br>9821013 Hz  | 1 + 3 kHz  | 1 kHz                          |
| MEASURE                    | 1.2  | e de | 1 1/1 2                          |                      |   | <b>8</b>                                | (C)<br>(C)<br>(100)                    |  | ter ter   | I 2  |                                |
|                            | The second secon | 775 mV at voltmeter input                | M, FM                            |                      | AF signal on<br>Bu 16   | 1.2 V<br>0.15 to 1.2 V                  | approx. 0.5 V                          |  | te te   | Two tone signal  1 kHz 3 kHz 999 mV 259 mV " 70 mV | ca. 1 V<br>1 kHz,Dist. < 0,3 % |
| PROCEDURE                  | Balance Adjustment<br>AF, RM, UNMOD (without CCITI)  | Readjust R 164 775 mV a                  | Voltmeter button MOD pressed : 8 | 15. Distortion Meter | All alignments on the 1 V range of the AF millivoltmeter, and on RM, UNMOO, without CCITT | Check out of autom. level control       | Notchfilter pressed:<br>fMOD + fTRANSM | 1) Adjust 3 potentiometers at a time alternatively in small increments for every attenuation pole frequency. | 2) Repeat adjustment, if<br>result is bad.  | Adjusting Ranges RM, 30 %: R Sinad : 10 %:         |                                |
| REQUIRED TEST<br>EQUIPMENT |  |  | 1                                |                      | AF Analyser with<br>a Beat Frequency<br>Oscillator  | 8.g.<br>Radiometer FRA 3                |  |  |   | Two Tone AF Gen.<br>e.g.<br>AF 40 S                |                                |
|                            | Adjus  |  |                                  |                      | est Pro   | Date                                    | ILE<br>Nat                             | ne   | 4020 seri<br>CONTROL AND DIS  |  |                                |

Schlumberger

01 0028.29 27.3,1980 Morasch

8**/**12 Sheet

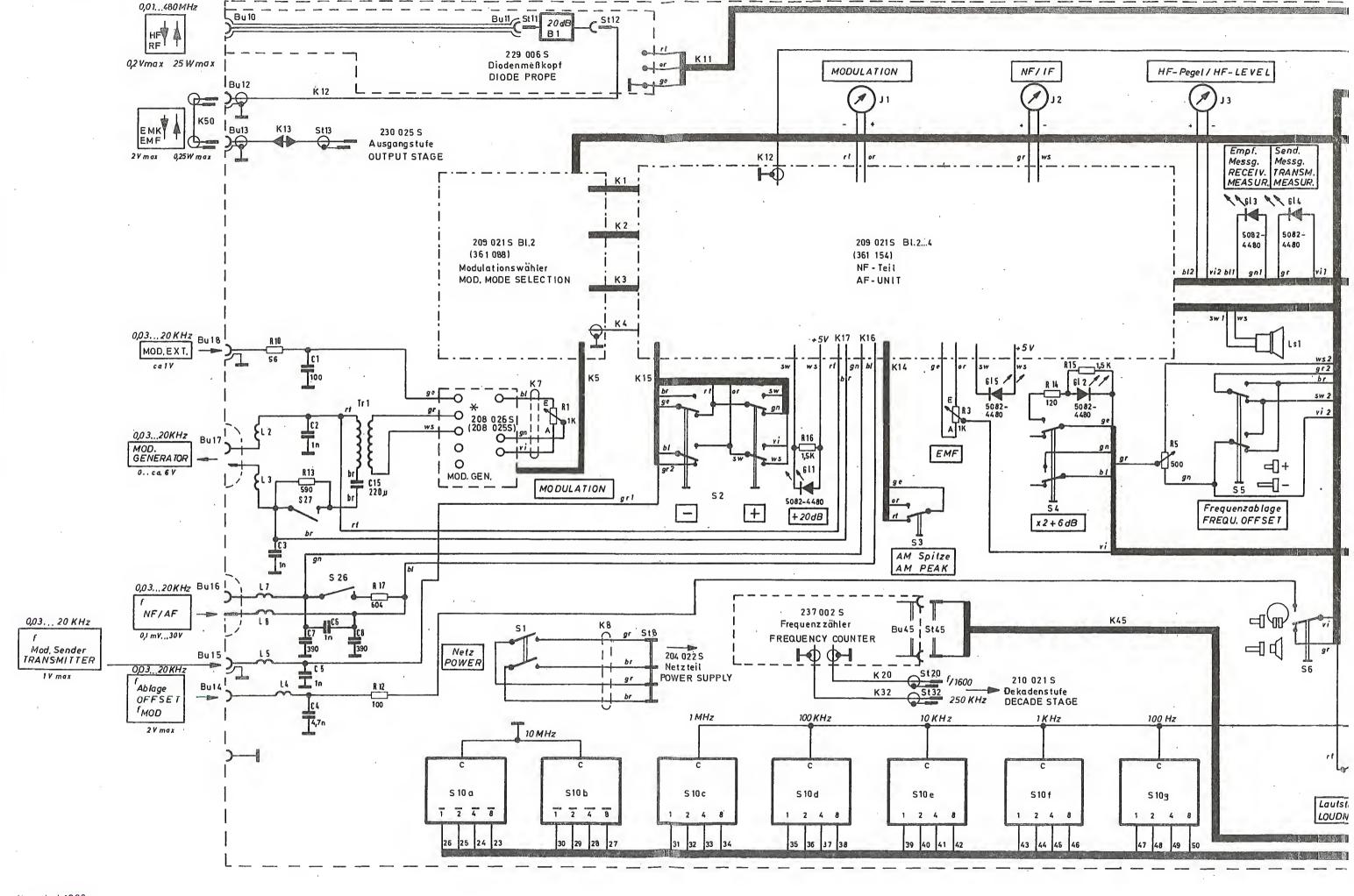
209 021 A

| MEASURED<br>VALUE          |   | 82                  |   |   |                                     |          |                  |                       | Mm          | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | yo                |                         |               |
|----------------------------|---|---------------------|---|---|-------------------------------------|----------|------------------|-----------------------|-------------|--|-------------------|-------------------------|---------------|
| REQUIRED VALUE             |   | 6.8 7.2 %           |   | 6.8 7.2 V<br>△U ≤ 10 mV                         |                                     |          | ► 250 mW reading | 10 mW reading         | 40 ± 1.2 mW | ► 2.5 W reading                        | ► 25 W reading    |                         |               |
| ADJUST                     |   |                     |   |   |                                     |          | alterna- R 110   | tively R 121 —        |             | R 112 —                                | R 114 -           |                         |               |
| FREQUENCY                  |   | 1 + 3 kHz           |   | <b>00</b>                                       |                                     |          | DC               | =                     |             | =                                      | ==                |                         |               |
| MEASURE                    |   | 1 2                 |   | <b>@</b> =                                      |                                     |          | -3               | =                     | =           | =                                      | u                 |                         |               |
| PROCEDURE                  | On TRANSMITTER MEASUREMENT mode  Replace discriminator signal from ouput stage (St 49/pin 5 or Bu 22/2) by a two tone AF generator.  4020 - Settino | ithout CCITT 999 mV | 16. Power Meter + AM Automatic Level Control . DC - 390 Q | AC - 1 11 V 220 μF DVM - 11 V 220 μF DVM        | Linearity, Power Measurement Ranges | DC level | + 3.8 V          | 0.25 W Range + 3.16 V | + 3.32 V    | 2,5 W Range + 5,53 V                   | 25 W Range + 11 V |                         |               |
| REQUIRED TEST<br>EQUIPMENT |   |                     | Transmitter 0 25 W  | capable of being<br>AM modulated,<br>Dist. < 1% |                                     |          |                  |                       |             |  |                   |                         |               |
|                            | Adjustmer   | t ar                | Alteration No.  | rocedur   |                                     | ıme      | $\dashv$         |                       | C           |  | 20 se<br>OL AN    | ries<br>DD DISPLAY UNIT |               |
| Sch                        | llumberger  | 01                  | 0028.29   | 27.3.1980                                       | Mo                                  | orasc    | h                | 9                     |             |  | 209               | 021 A                   | 9/12<br>Sheet |

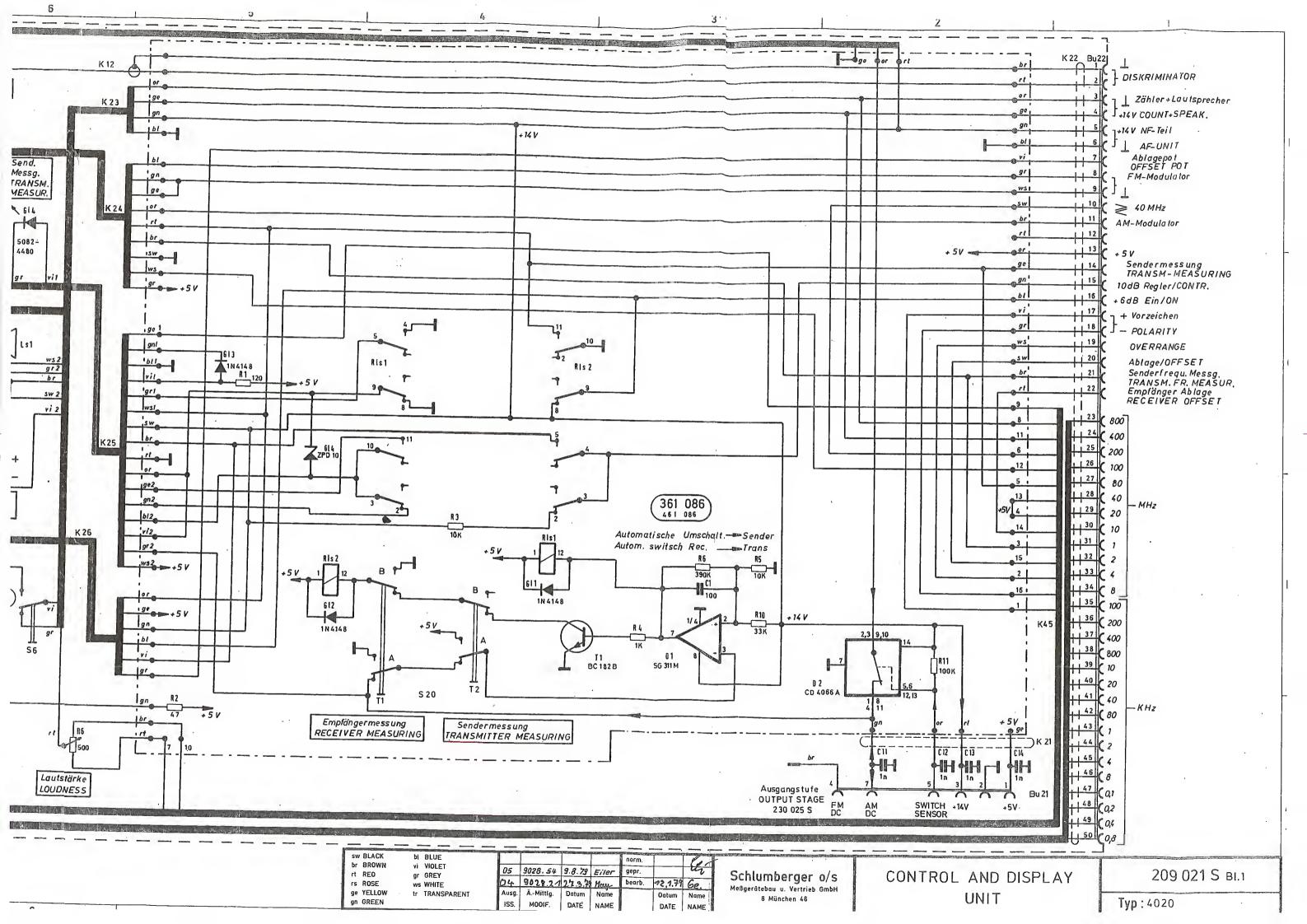
| MEASURED<br>VALUE          |       |          | yo               |                 | ,,, ok           | yo •••••        | 8                | 8       | 8                                       | 62                  |                        |          |                  | <i>B</i> • • • • • • • • • • • • • • • • • • • | , ok           |                       |          | *                  | •     |   |              |
|----------------------------|-------|----------|------------------|-----------------|------------------|-----------------|------------------|---------|---|---------------------|------------------------|----------|------------------|--|----------------|-----------------------|----------|--------------------|-------|---|--------------|
| REQUIRED VALUE             |       |          | Same AM reading  | appr. 80 %      | 808              | \$ 07           | 72 84 %          | 76 84 % | 2                                       | =                   |                        |          | 7.5 8.5 % (AM)   | (1 % (DIST)                                    | Vm 018 ••• 069 |                       |          | 18.5 21.5 W        |       |   |              |
| ADJUST                     |       |          | R 36             |                 | R 30             | R 25            | 1                |         | 1                                       | 1                   |                        |          | 1                |  |                |                       |          | 1                  | 1     |   |              |
| FREQUENCY                  |       |          | 1 kHz            | -               | =                | =               | 30 Hz            | 0.3 kHz | 1 kHz                                   | 10 kHz              |                        |          | 1 kHz            | 1 kHz  | 1 kHz          |                       |          | 1 kHz              | 30 Hz |   |              |
| MEASURE                    | 7     |          | _                | =               |                  | *               | =                |         | =                                       |                     |                        |          |                  | 1 2  | (8)            |                       |          | - 3                | 8     |   |              |
|                            |       | DC level | 5.65 V - 2.74 W  | 3.53 V \$0.11 W | 5.65 V \$ 2.74 W | 5.65 V - 2,74 W | 5.65 V \$ 2.74 W |         | u u                                     | =                   |                        | OC level | 3.53 V ♣ 0.11 ₩  |  |                |                       | DC level | 7.0 V 2 6.25 W     |       |   |              |
| PROCEDURE                  |       | AC level | 1.5 V            | 0.3 V           | 1.5 V            | 0.75 V          | 1.5 V            | =       | =                                       |                     |                        | AC level | 0.03 V           | <b>8</b> 2                                     |                |                       | AC level | 2.23 V             | =     |   |              |
| PROC                       | AM    | 4020     | TM, AM, 100 % ⊕⊡ |                 | TM, AM, 100 % () | ■ 50 % (+)      | IM, AM, 100 % ⊕⊡ |         | ① ① · · · · · · · · · · · · · · · · · · | (1) (+) II II II II | Inherent AM Distortion | 4020     | TM, AM, 50 % (+) | <b>⊕</b> 2                                     |                | Peak Power Indication | 4020     | TM, 25 W, AM, Peak |       |   |              |
| REQUIRED TEST<br>EQUIPMENT |       |          |                  |                 |                  |                 |                  |         |   |                     |                        |          |                  |  |                | 1                     |          |                    |       | 1 |              |
|                            | Adju  | str      | ner              | nt (            |                  | d T             |                  |         | _                                       | cedi                | -                      | Name     |                  | į  |                | 4020<br>ROL A         |          |                    | Y UNI | T |              |
| Sch                        | lumbe | rger     |                  | 0               | n                | ac.             | 0028,            |         | 2                                       | 7.3.1               | 980                    | Mora     | 100              | Panincam                                       |                | 021 A                 |          |                    |       |   | 10/1<br>Shee |

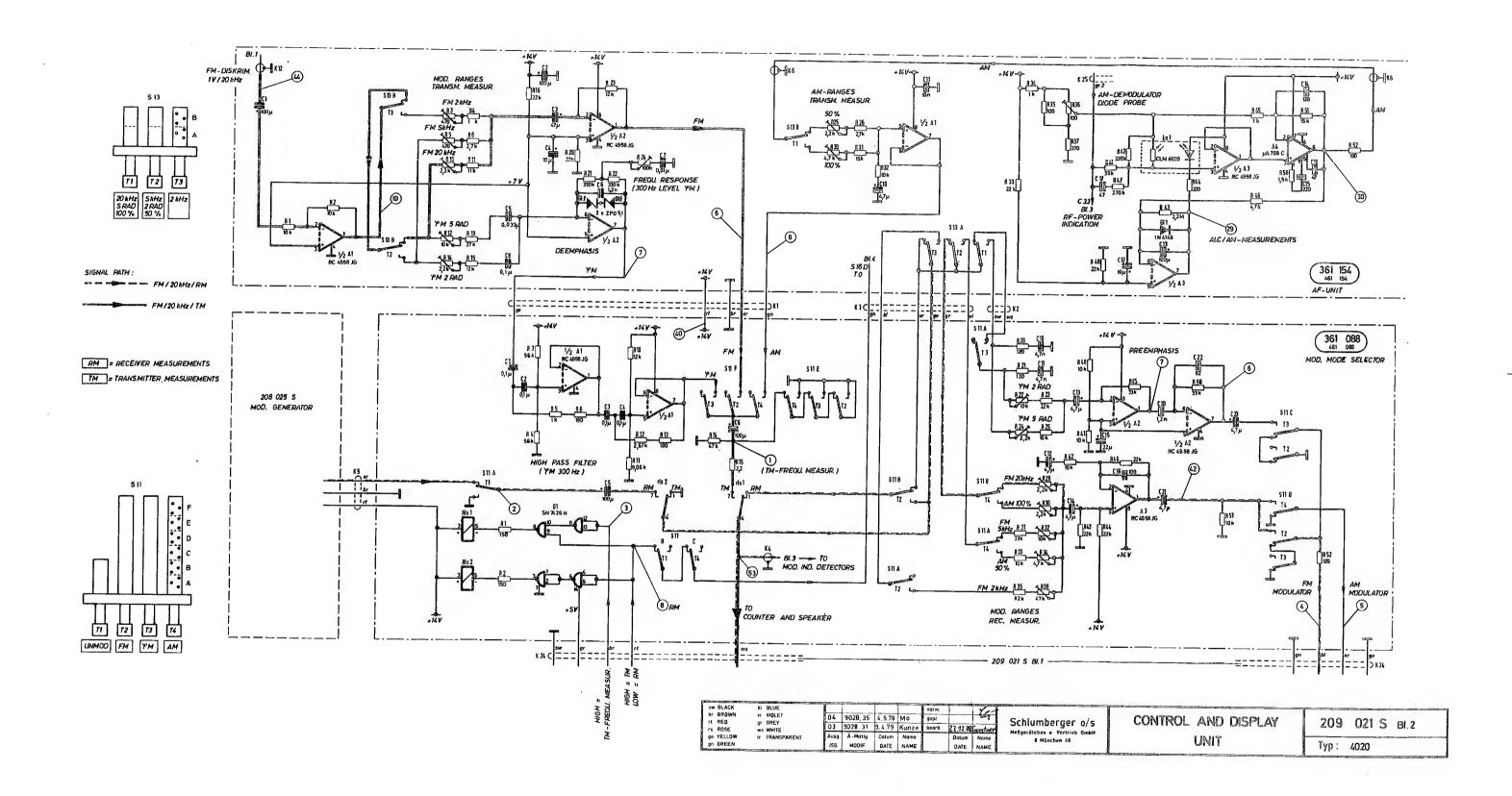
| מבטו ווספט דבי    |   |                                |                    |            |                  |                             |              |   |                   |
|-------------------|---|--------------------------------|--------------------|------------|------------------|-----------------------------|--------------|---|-------------------|
|                   | TEST PROCEDURE  | DURE                           |                    |            | MEASURE<br>POINT | FREQUENCY                   | ADJUST       | REQUIRED VALUE                              | MEASURED<br>VALUE |
|                   | 17. Modulation Generator Outout   | tout RM                        |                    |            |                  |                             |              |   |                   |
|                   | Check output level and  | Load                           | Ro < 6 12          | Ro = 50 kg |                  |                             | Set level to |   |                   |
| 30 kHz Distortion | distortion with the   | ١                              | 893                | 50 kg      | 1.2              | 1 kHz                       | п 0 30 mV м  | 0 > 30 mV                                   |                   |
| Meter             |   | 1                              | 8                  | =          | =                | e                           | и 0 2 V и    | 0 > 2 V                                     | yo                |
|                   | · ·   | ١                              | 8                  | =          | E                | =                           | 2 V          | 5 V Dist. < 1 %                             | 82                |
|                   |   | 1                              | 8 009              | =          | •                | •                           | ı            | 4.976 V n < 1 g                             | yo · · · · ·      |
|                   |   | ١                              | ŭ 009              | ö 009      | =                | =                           |              | 25 V ±40 mV " < 1 %                         | yo                |
|                   |   | 200 %                          | 8 9 >              | 50 kg      | =                | =                           |              | 5 V " < 1 %                                 | yo ····           |
|                   |   | 200 2                          | 8 9 >              | 50 kg      | 2                | 50 Hz                       |              | 5 ( ( 5 %)                                  | ۸                 |
|                   | Test for ungroundet output  | but                            |                    |            | Bu 17            | 00                          |              | > 1 MQ across output<br>contacts and ground | yo ···            |
| 4021 /22          | Return Loss Mod. Generator Level S 27 / 600 \( \text{AF.40} \)  EMF check out | Frequency control to EXT Bu 17 | control<br>4021/22 | M NO       | Bu 17<br>S 1     | 100 H2<br>10 kH2<br>100 kH2 | >            | 0,5 V + 75 mV = 16,5 dB                     | Лш••••            |

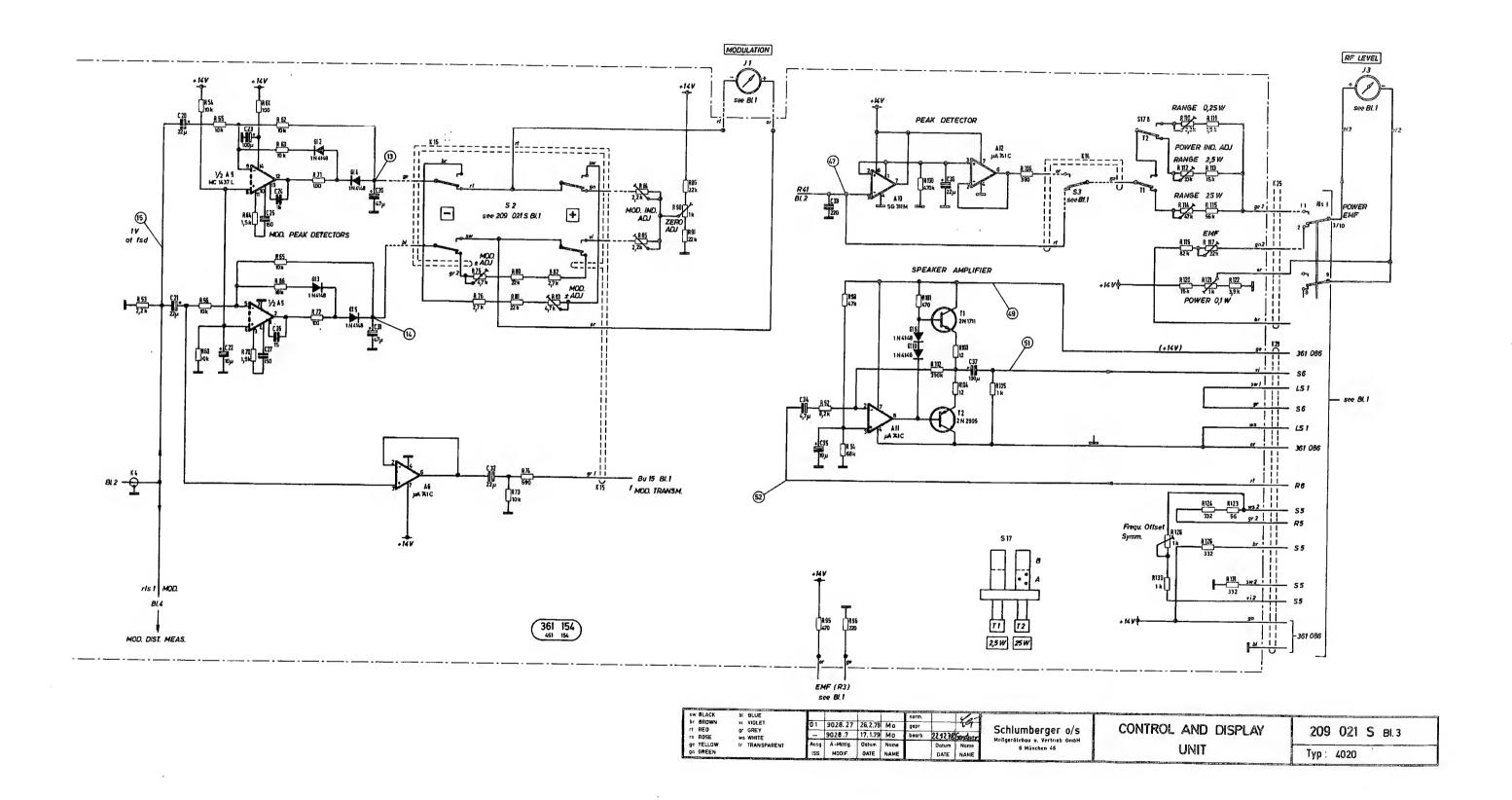
| MEASURED<br>VALUE          | ok   |  | yo      |      |  |                         |
|----------------------------|--|--|---------|------|--|-------------------------|
| REQUIRED VALUE             | sufficient loudness  | Power reading appr. 10 W                               | TS II   |      |  |                         |
| ADJUST                     |  |  | 1       |      |  |                         |
| FREQUENCY                  | 1 KHz ,<br>1 KHz   | 20   | 1 kHz   |      |  |                         |
| MEASURE                    | LS 1<br>Bu 14  | -3   | 1 1/1 2 |      |  |                         |
| PROCEDURE                  | 18. Loudspeaker Pull and turn up control knob for loudness until sound overdriving becomes audible. Press knob, but do not turn. | 19. RM / TM Automatic<br>Test plug RM + TM not pressed | 39      | 2    |  |                         |
| REQUIRED TEST<br>EQUIPMENT |  | Test plug  |         |      |  |                         |
|                            | Adjustmen  | 4020 series  |         |      |  |                         |
| Sch                        | lumberger  | Issue Altera   | 1.29 27 | Name | CONTROL AND DISPLAY UNIT  209 021 A  Replacement for | 12 <b>/</b> 12<br>Sheet |

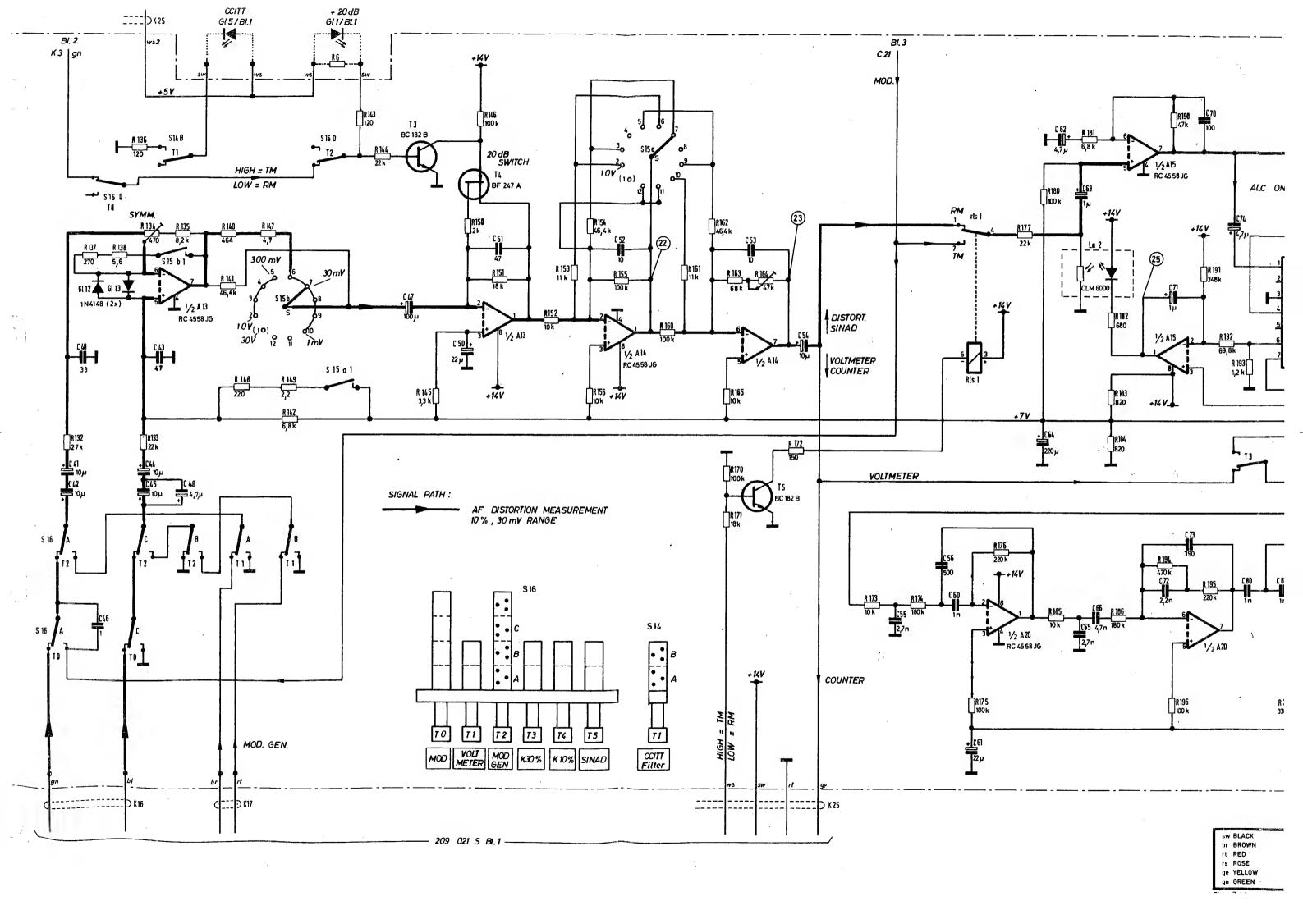


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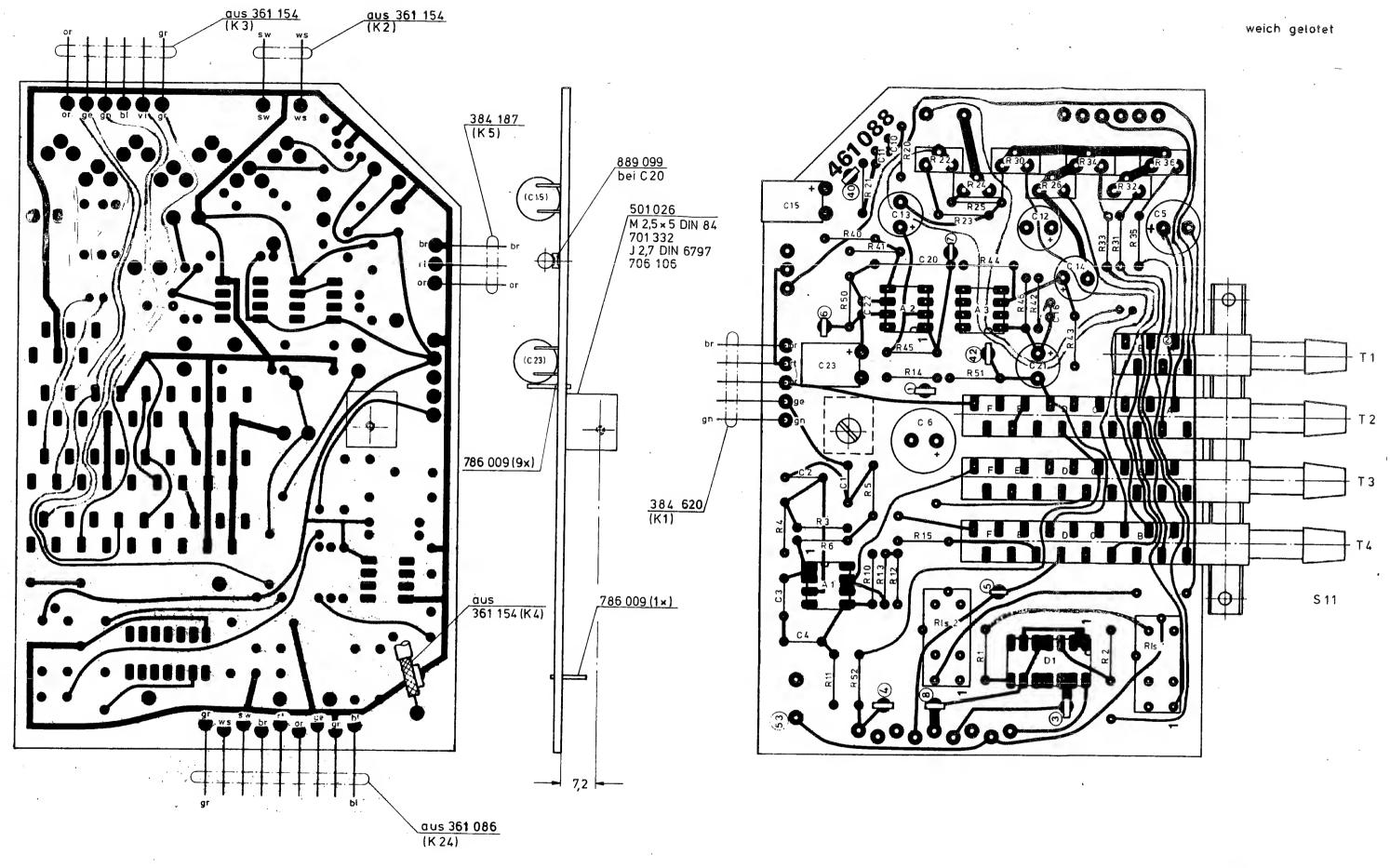






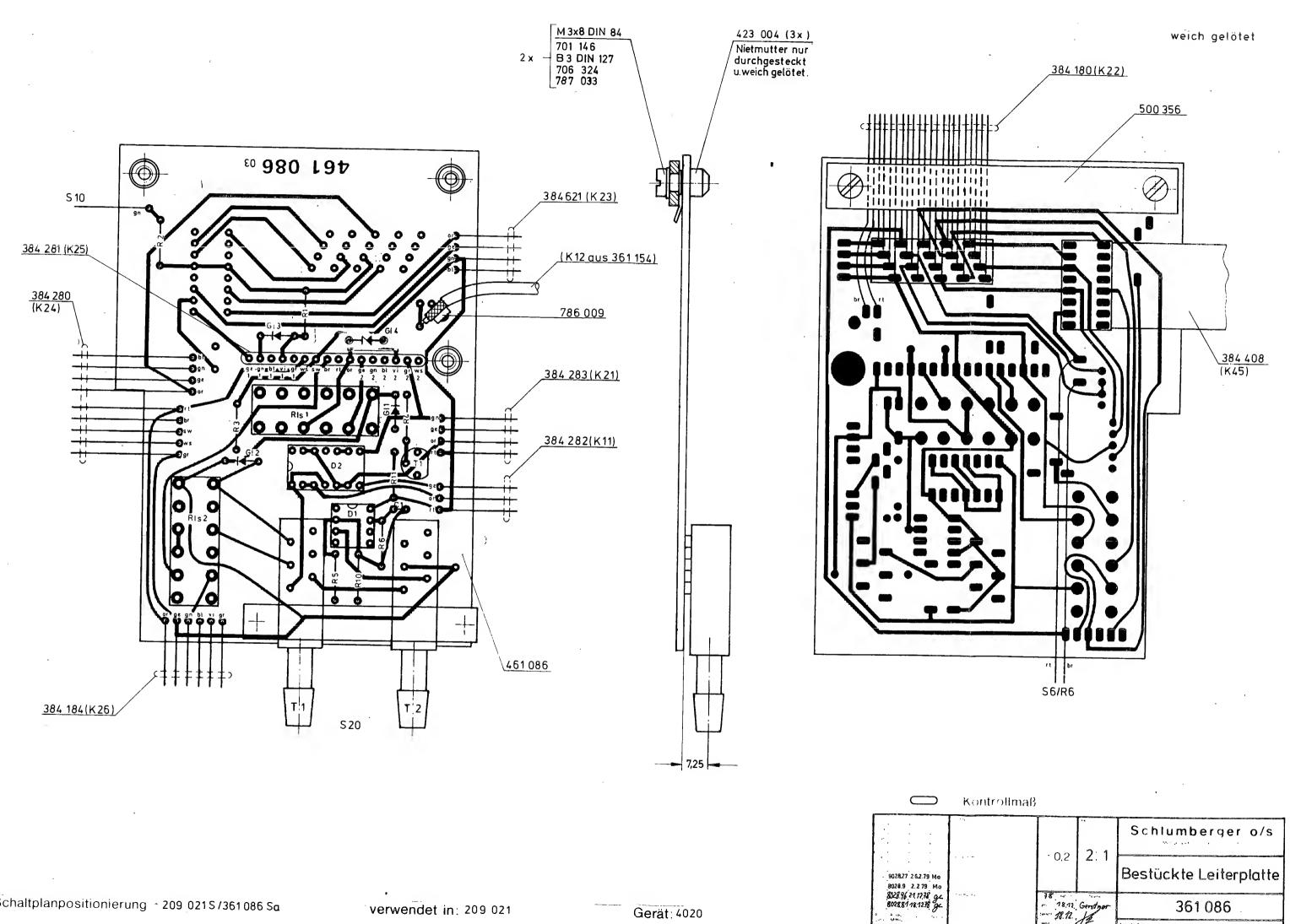


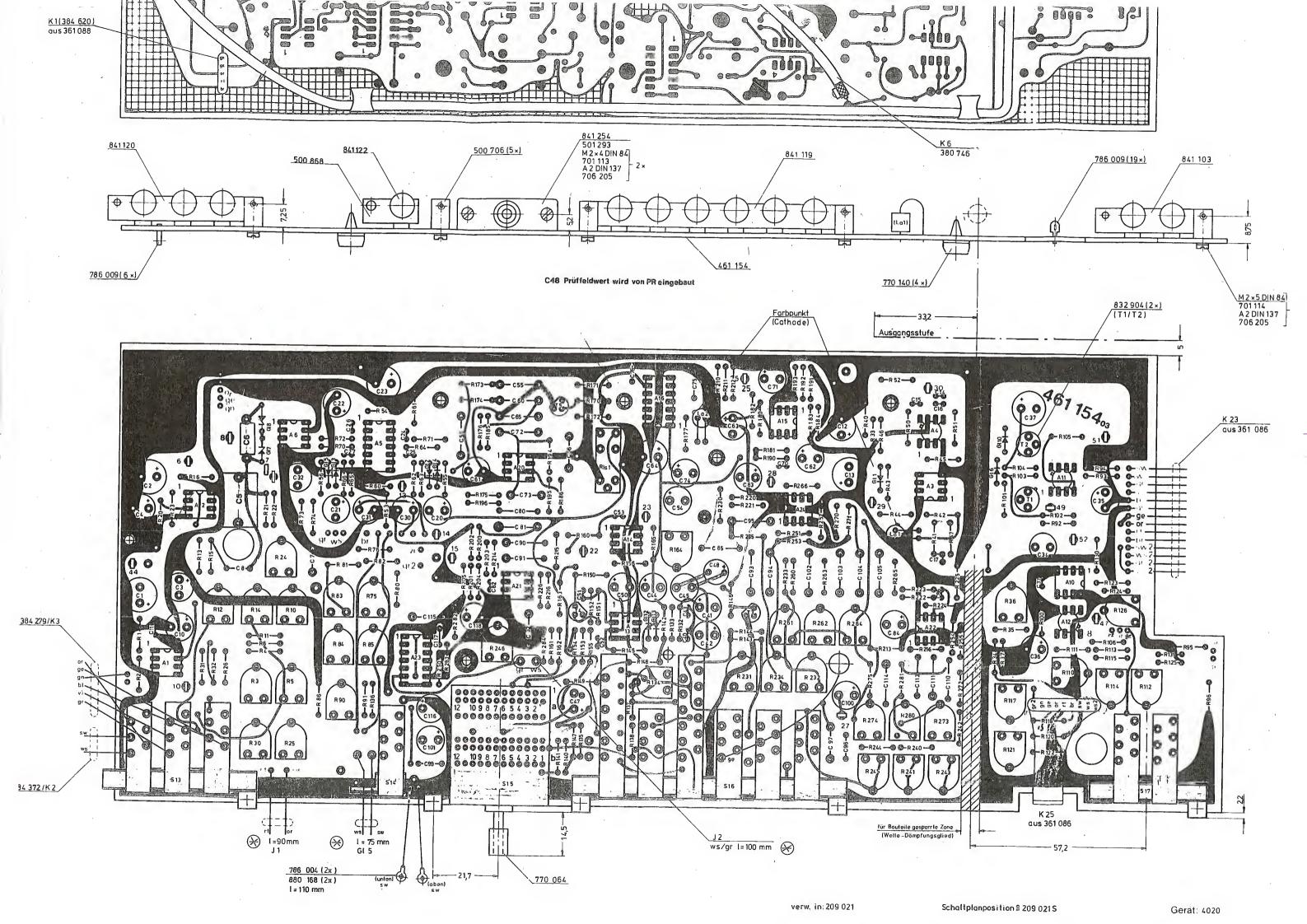


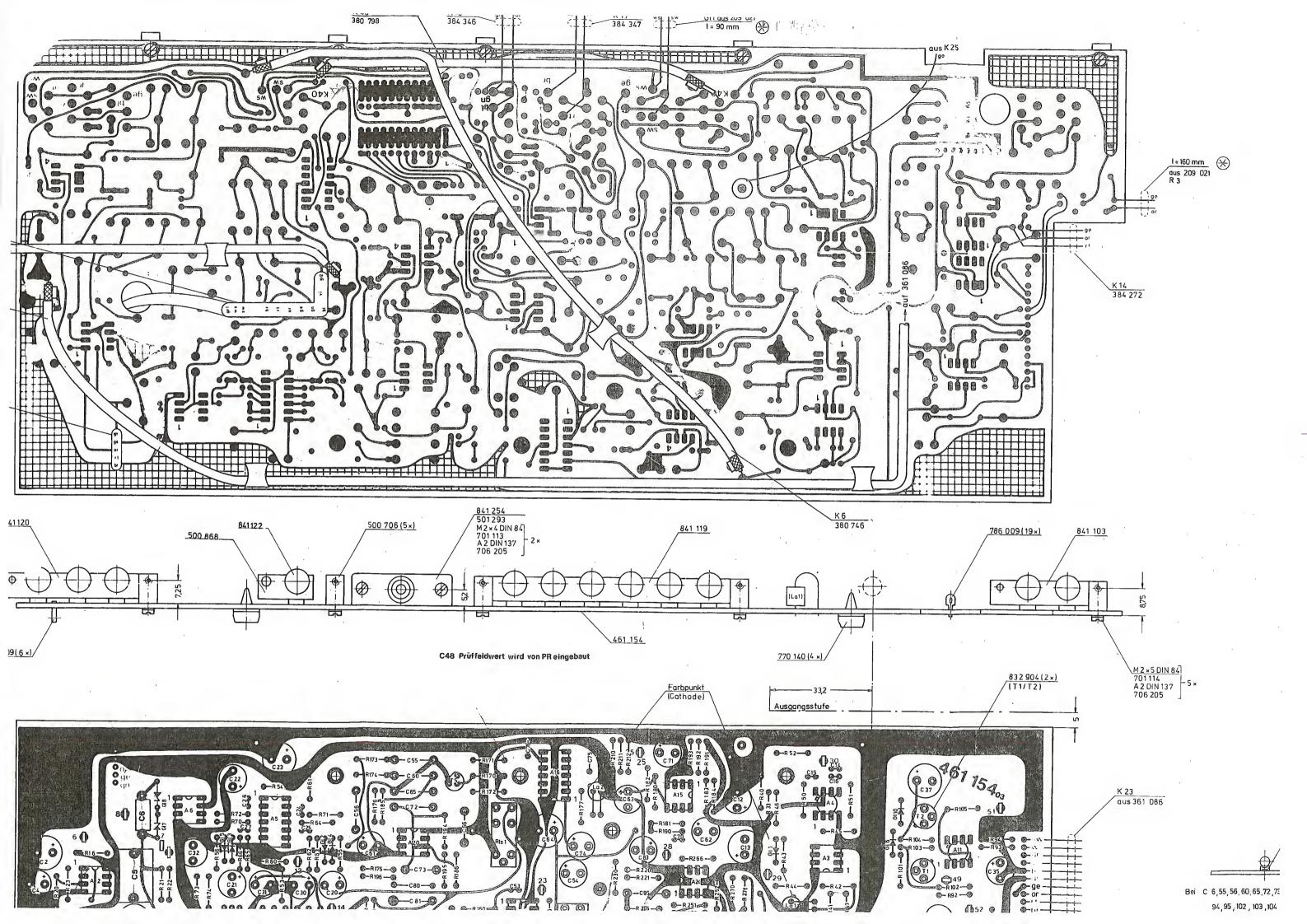


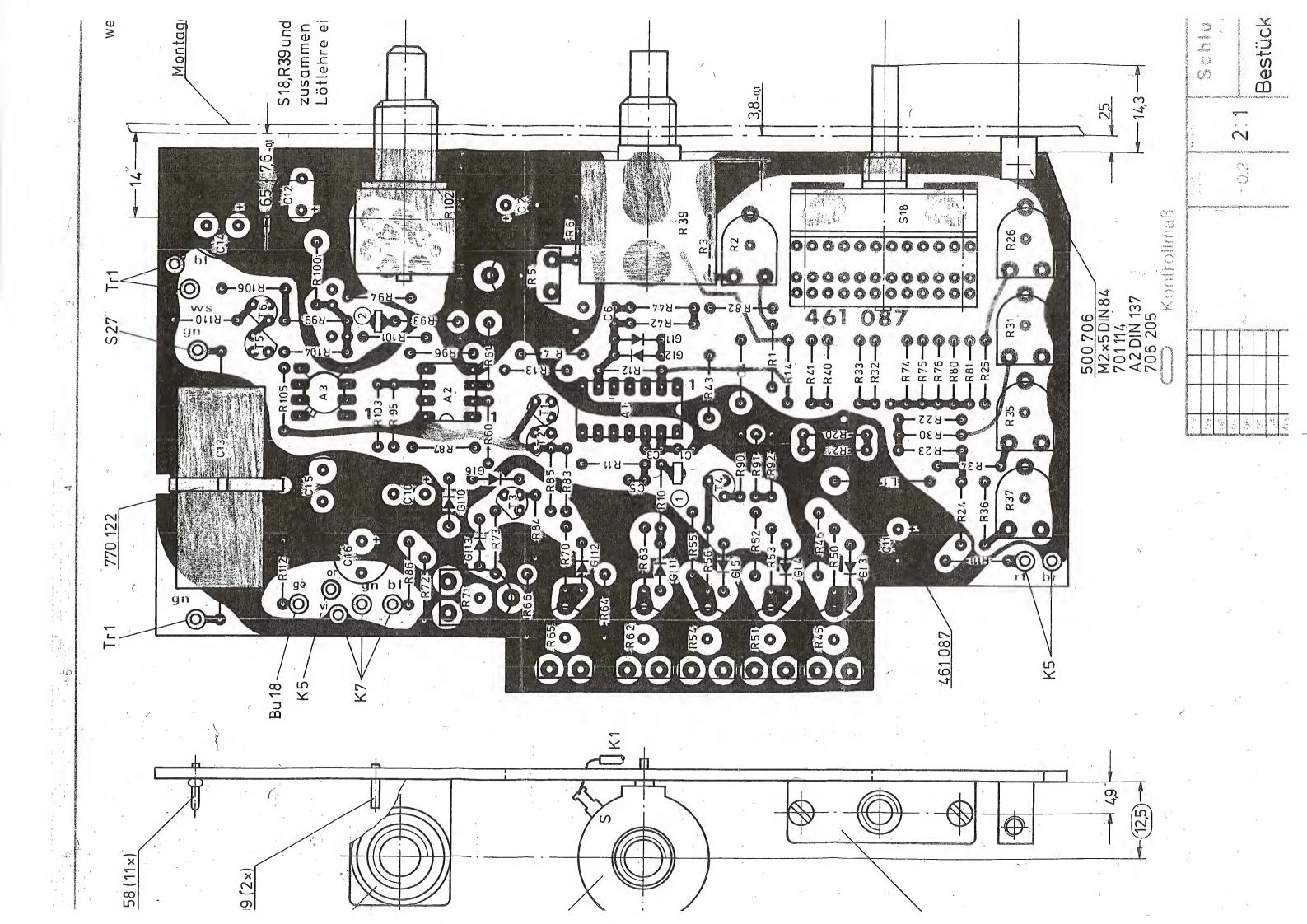
## = Kontrollmaß

| 10     | 1 1             | !        |       | G-Med        | , . end |       | MARKINT     |                                 |
|--------|-----------------|----------|-------|--------------|---------|-------|-------------|---------------------------------|
| 09     |                 |          | !     |              | **** 3  | 100   |             | Schlumberger o/s                |
| 08     |                 |          |       |              |         |       |             | MeRgeratebai i Vertriet, Gmbiri |
| 07     |                 |          |       |              |         |       | 3.4         | Wengermoon / Virtuel, Groun     |
| 06     | 1               |          |       | Werksty#     | 一 ±     | 0,2   | 2.1         |                                 |
| 05     | 9028 41         | 28 6.79  | Eiler |              |         |       |             | Bestückte Leiterplatte          |
| 04     | 9028.31         | 10.4 79  | Kuńze |              |         |       |             | Destuckte Letter plutte         |
| 0.3    | 9028 15         | 21 3.79  | Mo    |              |         |       |             |                                 |
| 02     | 9028.9          | 6.2.79   | 16    | Oberfile: :w | 78      | Datum | Name        |                                 |
| 01     | 202894          | 16 10 13 | oi.   |              | 361     | 10.10 | R. Gerstuer | 361 088                         |
| Aus    | Andg            | Teture   | Name  |              | bearb   | 18.40 | 1610        | 60.000                          |
| E GRIX | I MANUAL STREET |          |       |              | 7       |       | D 10 10 1   |                                 |









(see block circuit diagram 102 820 B for total instrument)

The frequency of the ramp generator is dictated by restistors for switching and vernier adjustment. An operation amplifier the feedback of which is a function of signal level converts the ramp signal into a low distorsion sinusoidal signal. The external output level can be continuously adjusted in two ranges.

Besides internal modulation also external or simultaneous internal and external modulation is possible. The external modulation depends on the level of the external AF generator.

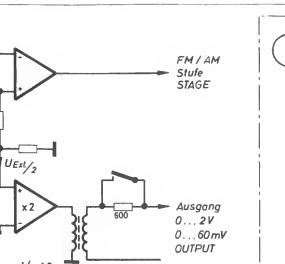
The source impedance of the symmetrical transformer output can be switched to  $600\,\Omega$  or  $<6\,\Omega$ .

|              | Function Description | 208 025 / 026 F      | Sheet 1/1 |
|--------------|----------------------|----------------------|-----------|
| Schlumberger | Type: 4020/21/22     | Modulation Generator | Date 0979 |

| Sch                   | REQUIRED TEST EQUIPMENT | PROCEDURE   | MEASURE           | FREQUENCY          | ADJUST | REQUIRED VALUE        | MEASURED   |
|-----------------------|-------------------------|---|-------------------|--------------------|--------|-----------------------|------------|
| lumberge              | Adjustr                 | Preset all adjustment potentiometer to middle position apply + 14 V + 10 mV to the rail pin. Select Ro $\langle \cdot 6 \ \Omega \rangle$ , terminate with 600 $\Omega_{\bullet}$ . |                   |                    |        |                       |            |
| Iss                   |                         | 1. Integrator + Schmitt - Trigger   | (                 | -                  |        |                       | 1          |
| sue Alto              | Oscilloscope            | 2   | Э                 | approx. 7 KHZ      |        | 00 - 6.5 V            | dd )       |
| 022.48<br>022.87      | Test P                  | S 18 : Ext. connect + 14 V to S 18 slider (T1/C4)   | A 4 0             |                    |        | 0                     |            |
| Date                  | roced                   |   | A 1/Pin 2         |                    |        | 0 2 V                 | ok         |
| 1                     | ure                     | 2. Sinus Shapiny Network  |                   |                    |        |                       |            |
| Name<br>Livry<br>Shuh |                         | S 18 : 1 kHz  | FM, AM.           | approx. 1 kHz      |        | approx. 4 V distorted |            |
| _                     |                         | R 102 fully clockwise, S 2 pressed  | Mod.Gen<br>output |                    |        | · <u>·</u>            | , ok       |
| 208                   |                         | 3. Frequency Adjustment ( + 14 V ± 10 mV !)   |                   |                    |        |                       |            |
| 026                   | Counter                 | S 18 1 6 kHz  | FM, AM            | -                  |        |                       |            |
|                       |                         | 3 KHZ   | output<br>= =     | 3 KHZ              | 8 31   | 13 KHZ                | KHZKHZ     |
| FOR                   |                         |   |                   | 2,7 KHZ<br>1 KHZ   |        | L 2,7 kHz ± 0,5 %     | KHZ<br>KHZ |
|                       |                         | B 0,3 kHz   |                   | 0,4 KHZ<br>0,3 KHZ | R 37   | 1 0,3 kHz             | kHz        |
|                       |                         |   |                   |                    |        |                       |            |
| 1/2<br>Sheet          |                         |   |                   |                    |        |                       |            |

| MEASURED<br>VALUE          |   |  | dd /          |   | ,ok       |                          |                       | , ok                                 |   |               | kHzkHz                  | kHz<br>kHz        | kHz<br>   |              |
|----------------------------|---|--|---------------|---|-----------|--------------------------|-----------------------|--------------------------------------|---|---------------|-------------------------|-------------------|-----------|--------------|
| REQUIRED VALUE             |   |  | 6,5 - 0,5 V   | 0 + 2 V + 12 14 V                                 | 0 2 V     |                          | approx. 4 V distorted | ~ <u>.</u>                           |   |               |                         | L 2,7 kHz - 0,5 % | 0,3 kHz   |              |
| <br>ADJUST                 |   |  |               |   |           |                          |                       |                                      |   |               | R 31                    |                   | R 37      |              |
| FREQUENCY                  |   |  | approx. T KHZ |   |           |                          | approx. 1 kHz         |                                      |   |               | 6 KHz<br>3 KHz<br>3 KHz | 7 KHZ             | 0,3 kHz   |              |
| MEASURE<br>POINT           |   | (  | )             | A<br>⊕  | A 1/Pin 2 |                          | FM, AM-<br>output     | Mod.Gen<br>output                    |   | Mod. Gen.     | output<br>B             |                   |           | !            |
| PROCEDURE                  | Preset all adjustment potentiometer to middle position apply + 14 V $\pm$ 10 mV to the rail pin. Select Ro $<\cdot6$ $\Omega_{\rm p}$ terminate with 600 $\Omega_{\rm s}$ | 1. Integrator & Schmitt - Trigger S 18 : 1 kHz (S 18 - Erecu rance cuttab) | ting          | S 18 : Ext. connect + 14 V to S 18 slider (T1/C2) |           | 2. Sinus Shaping Network | S 18 ; 1 kHz          | o n luz Tully Clockwise, 5 2 pressed | 3. Frequency Adjustment ( + 14 V + 10 mV !) | S 18 : 6 kliz | 8 3 kHz 2.7 kHz         | # 7 KH2           | 8 0,3 kHz |              |
| REQUIRED TEST<br>EQUIPMENT |   | WAQ  | Oscilloscope  |   |           |                          |                       |                                      |   | Counter       |                         |                   |           |              |
| 4                          | Adjustn   | nent (   |               | est P   | roced     |                          | Name                  | M                                    |   | 1020 s        | eries<br>ENERAT         | OR                |           |              |
|                            | Moegae  |  | - 4:2         | 0.02-   | 5,10.     |                          | Kams                  |                                      | 208   | 025           | A                       |                   |           | 1/2<br>Sheet |

| EQUIRED TE                                 | EST PROCEDURE  | MEASURE            | FREQUENCY         | ADJUST   | REQUIRED VALUE                            | MEASURED<br>VALUE |
|--|--|--------------------|-------------------|--|---|-------------------|
|  | 4. Distortion Factor Adjustment  |                    |                   |  |   |                   |
| AF Analyser<br>(e.g. Radiometer<br>FRA 3)  | S 18 : 1 kHz   | <u>O</u>           | 1 kHz (2 kHz)     | R 5  | second harmonic                           | O0                |
|  | S 18 : 1 kHz, R102 fully clockwise, S2 pressed                                       | Mod.Gen.<br>output | 1 kHz             | R 45 + R 71<br>R 51 + R 65<br>R 54 + R 62<br>in couples                      |   |                   |
|  | S 18 : 13 kHz R 39 min. frequency  | •                  | 780900 Hz         | repeated<br>R 2  | Dist. < 0,35 %                            | 86 86             |
| •  | S 18 : 30100 Hz R 39 min. frequency  | • •                | < 30 Hz<br>10 kHz |  | Dist. < 3%<br>Ofst. < 3%                  | 80 80             |
| Dist. Analyser<br>used as a<br>level meter | 2. [   | FM,AM-<br>output   | 1 kHz             |  | 1,651,85 V                                | ۸                 |
|  | Mod.Gen. output loaded with 220 n<br>S 18 : 1 kHz R 102 fully clockwise, S 2 pressed | Mod.Gen            |                   |  | 22,3 V                                    | ۸                 |
|  | . s 2 pulled   | -                  |                   |  | 30 35 mV                                  | Ve                |
|  | 8 30 Hz100 Hz, R 39 min. frequency<br>R 102 fully clockwise, S 2 pressed             | ressec             | < 30 Hz           |  | 1,72,3 V                                  | λ                 |
| AF Generator<br>1 MHz 1 V                  | 6. Ext. Mod - Input<br>S 18 : ext. 1 kHz, 1 V applied to the ext Mod input           | FM, AM.            | 1 kHz             |  | 1 V (- input level)                       | , o v             |
| Oscilloscope                               | 7. Checkout of the 10 turn control notentionster S 18 : 0,31 kHz                     | FM,AM<br>output    | 0,3 1 kHz         | turn R 39 slowly no fraquency jump<br>over tho whole range from 0,3 to 1 kHz | no frequency jumping<br>from 0,3 to 1 kHz | ok                |
|  |  | -                  |                   | _  |   |                   |



Integrator

1/2 A1

 $\Box$ 

Umod ext.

Frequenz FREQUENCY

Schmitt - Trigger

1/2 A1

Sinus - Umformer SHAPER

MODULATION

0...17

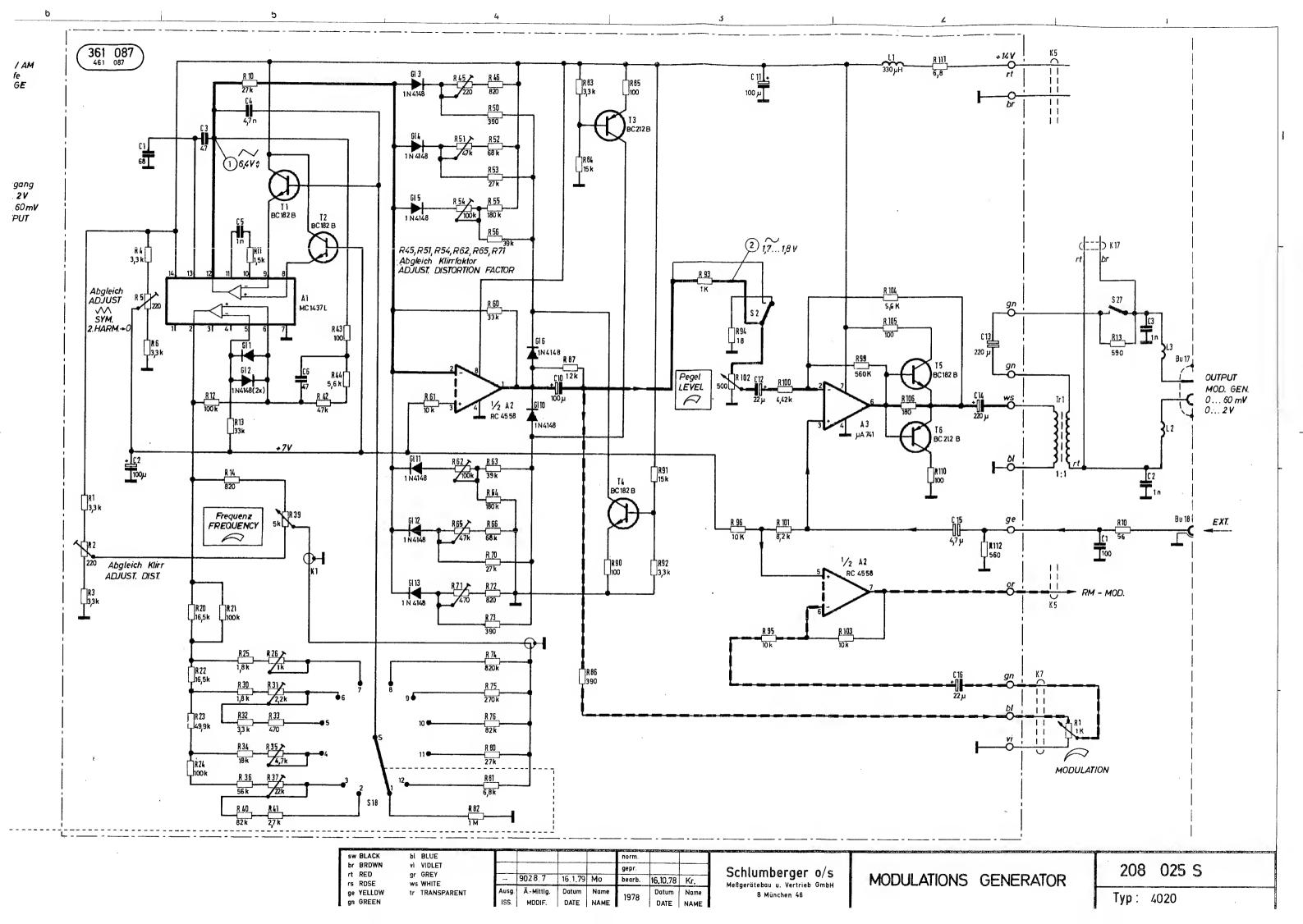
Pegel LEVEL

> Ausgangsverstärker OUTPUT AMPLIFIER

| Bereich<br>RANGE | Frequenz<br>FREQUENCY |
|------------------|-----------------------|
| 2                | 0,3 kHz               |
| 3                | 0,4 kHz               |
| 4                | 1,0 kHz               |
| 5                | 2,7 kHz               |
| 6                | 3,0 kHz               |
| 7                | 6,0 kHz               |
| 8                | 0,03 0,1 kHz          |
| 9                | 0,1 0,3 kHz           |
| 10               | 0,3 1,0 kHz           |
| 11               | 1,0 3,0 kHz           |
| 12               | 3,0 10,0 kHz          |
| 1                | EXT. MOD.             |

361 461

R1 3,3 k



(See block circuit diagram 102 820 B for total instrument)

The fully integrated counter provides direct drive of the display in conventional Strobe method, for which it requires merely the counting frequency, the reset pulse, the transfer pulse (transfer of the counter status into the readout store) and the flashing frequency. Its negative feed voltage is generated by a DC/DC converter from +5 V.

The frequency of the reset transfer pulse and flashing frequency is derived by frequency deviders from a 250 kHz signal having crystal accuracy and switching in accordance with the nature of the counting frequency. The flashing frequency is provided to the counter only when the RF amplitude in the oscillator stage ("RF-ALC") is too low or on overflow readout, i.e. >9999.

The counting frequency is conditioned by various means depending on the mode of operation:

- 1. The modulation frequency f<sub>MOD</sub> or the input frequency of the voltmeter is quadrupled by an input amplifier having automatic level control in 2 frequency doublers. Thus attaining a faster counter readout, (4 times/sec) for 1 Hz resolution.
- 2. The offset frequency " $\Delta f$  (AC)" is presented directly. (Depending on resolution, the reset frequency is 10 or 1 Hz.)
- 3. When establishing transmitter frequencies or indicating synthesizer frequency > 40 MHz the frequency 40...480 MHz is presented divided 1600

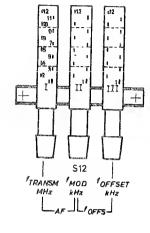
by 7 as the counter frequency.

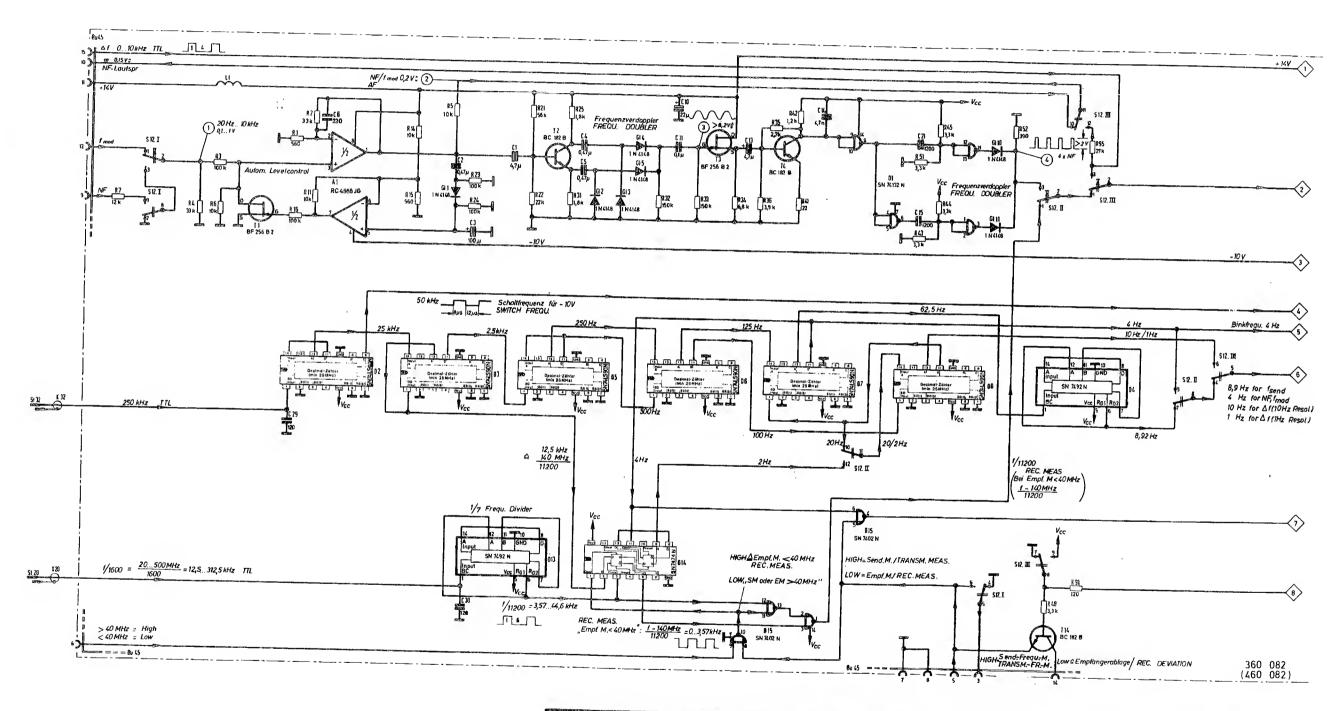
When indicating the synthesizer frequency <40 MHz the frequency  $\frac{140...180 \text{ MHz}}{1600}$  is de-mixed using a D Flip Flop analogous to de-mixing

in the output stage and in the counter stage also.

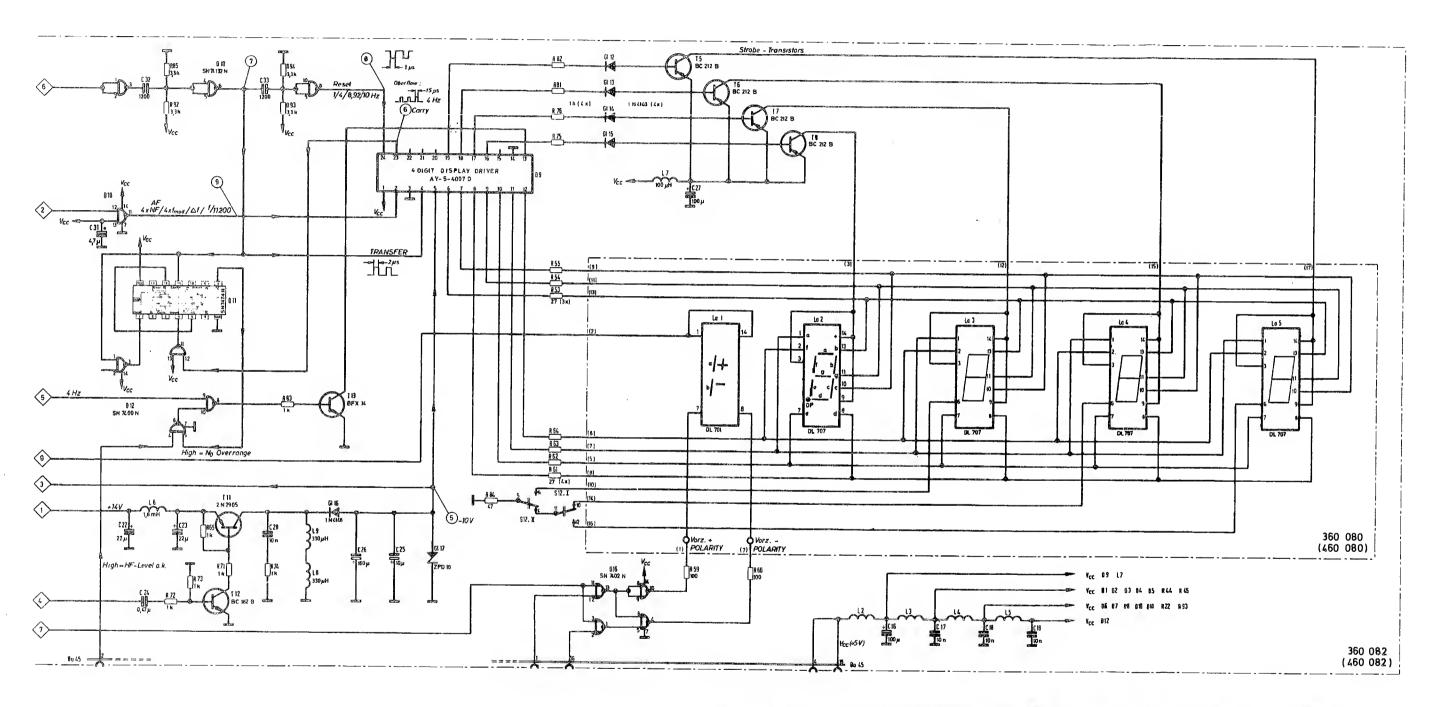
|              | Function Description | 237 002 F         | Sheet 1/1 |
|--------------|----------------------|-------------------|-----------|
| Schlumberger | Type: 4020/21/22     | Frequency Counter | Date 0979 |

| t procedure, the cours of the instructed to ext.  I mV position  I kHz  I kHz | REQUIRED TEST  REQUIRED TEST  Gould (4010 A)  Ois, Voltmeter  Obecillascope for trouble shoeting)  For carrying out the test procedure, the councer to by 35, 35, 32 and 35, 20 to the instruction to but the test procedures.  Gounter Functions  Counter Functions  Counter Functions  Counter Functions  AF Voltmeter range in 1 mV position button UNKOD pressed  TO Whiz Output on rear panel connected to HF Voltmeter range in 1 mV position button UNKOD pressed  TO Whiz Output on rear panel connected to HF Voltmeter range in 1 mV position butled for Fig. Sange 5 kfz, Oevistion 0,5 kHz  FM, Range 5 kfz, Oevistion 0,5 kHz  Modilationgenerator  To HK On the Connected to HK Modilation output connected to Modilation output connected to HK Modilation output connected to MF Millivoltmeter input for gange = 1 mV  Medul, Generator output formeted to my | REQUIRED TEST  REQUIRED  GOILD (4010 A)  For carrying out the test procedure, the coulons of the instruction | REDI IIRED VALUE MEASURED | can be placed outside of the instrument.   | -9 -11 V<br>on (5) 360 082                        | RECEIVER TRANSM. Frequ. TRANSM <sup>®</sup> MOO fabt. Counter Loud  NEASUREMENT MEASUREM. Setting | 020,0<br>140,0<br>479,0<br>000,0  | blinks<br>-01,00 Noise<br>-01,00 10,1 kHz<br>blinks   | X X -1,000 1 KHz X X -1,000 1 KHz X X X -1,000 1 KHz | X +00,2. appr.250Hz | 0,030 30 Hz<br>1,000 1 kHz<br>9,900 9,9kHz<br>0,100 10,1kHz         |                        |
|--|--|--|---------------------------|--|---|---|---|---|--|---------------------|---|------------------------|
|  | Adjustment and Test Procedure  | Adjustment and Test Procedure    Same   Alteration No.   Date   Name   |                           | For carrying out the test procedure, the counter Connect Bu 35, St 32 and St 20 to the instrument. Caution! MOS-Counter 0 9 is highly sensitive again MOS handling procedures. | Check negative Supply Potential Counter Functions | REA   | Mod. Generator switched to ext.  AF Voltmeter range in 1 mV position button UNMOD pressed | 10 MHz Output on rear panel connected to HF DIRECT socket AF Voltmeter range in 1 mV position |  | l fully<br>links )  | Range 5 kHz, Oeviation 0,5 1<br>ilationgenerator 30<br>1 H<br>9,9 H | mected to<br>Range = 1 |
| A Maria II   | 1 1334 INTERITION NO I INCA I VARANTI VARIATION  | 12.5.76 Schul  | LE.                       | Adjustme   |   |   |   | -   |  |                     |   |                        |

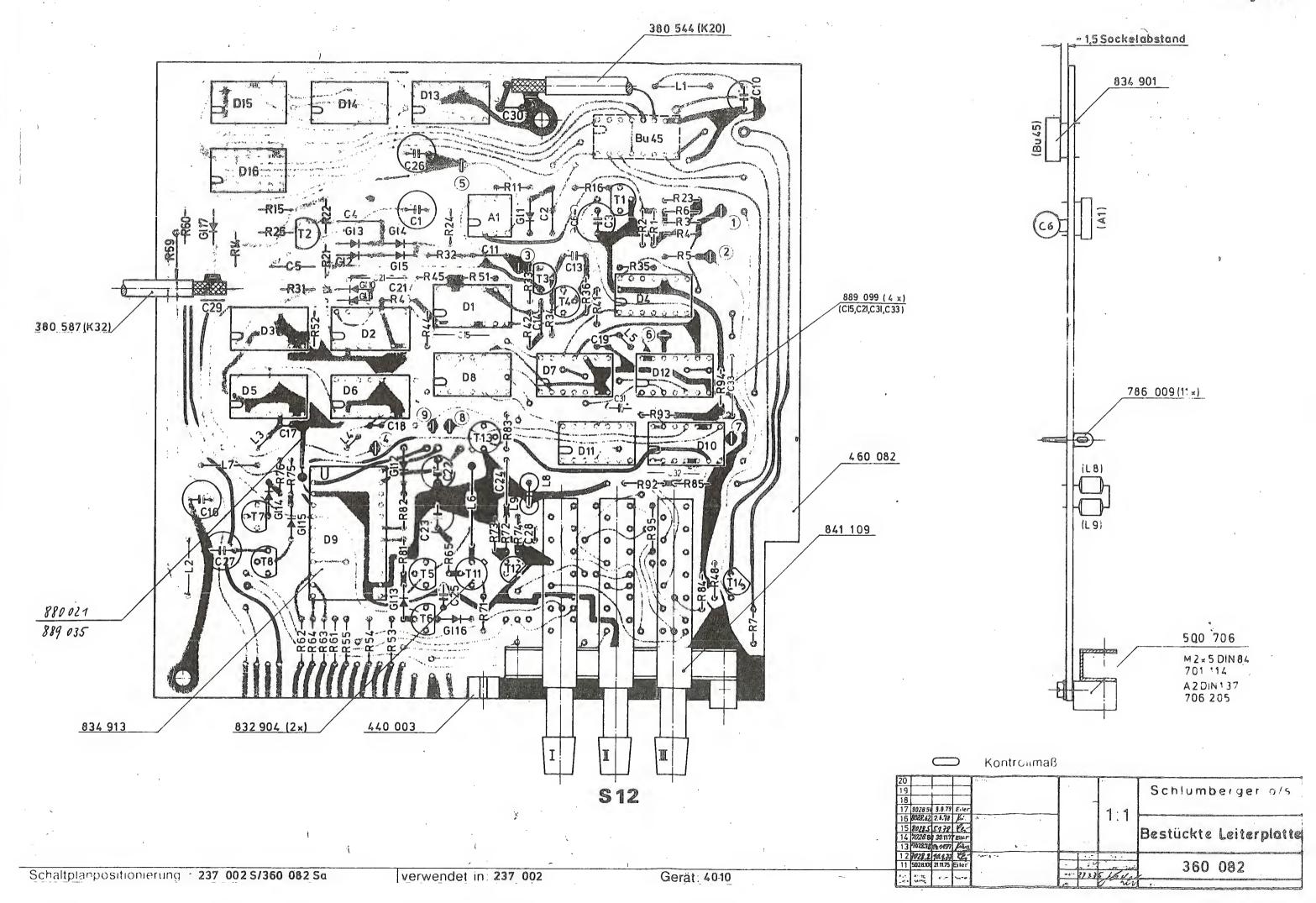


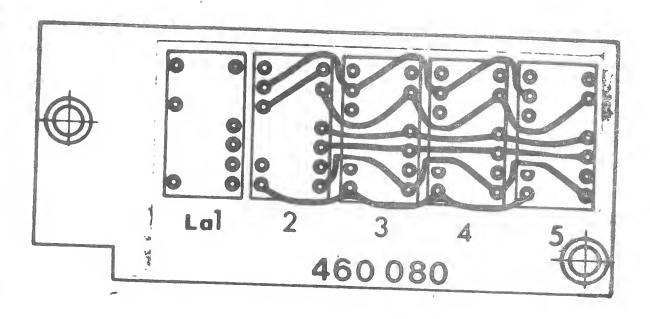


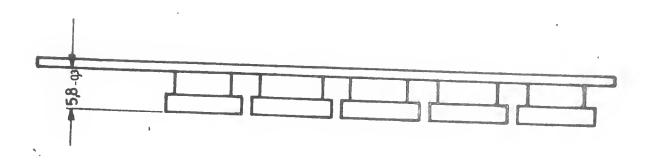
|                                | the state of the s |          |              |          |              |        |                   |      |  |  |  |
|--------------------------------|--|----------|--------------|----------|--------------|--------|-------------------|------|--|--|--|
| SOV BLACK                      | M BLUE   | 11       | 7028.95      | 21.12.77 | Wn           |        | -                 |      | 4  |  | 1  |
| br BROKIN                      | VI VIOLET  | _        | 1,020,00     | 21.12.17 | 4441         | norm   |                   | MAG  | <b>2</b> -   | the second of th |  |
| rt RED                         | gr GREY  | <u> </u> | <del> </del> | -        | L            | gepr   | 1                 | the  | Schlumberger c/s   | Fraguesz-ühlen   | 205 222 2  |
| rs ROSE                        | WS WHITE   | 12       | 8028.5       | 9.1.78   | Kc.          | baorb. | 26, 2,75          | Kr.  | a committee de 10/2  | Frequenzzähler   | 237 002 S BLI  |
| ger YELLOW                     | Ir TRANSPARENT   | Ausg     | AMittig.     | Dotum    | Nome         |        | Datum             | Nome | Mellgarātabau u Yerlrieb GmbN  |  |  |
| gn GREEN                       |  | ISS      | MODIF        | DATE     | NAME         | 1975   | 1                 |      | B Münchos 46   | FREQUENCY COUNTER  |  |
| THE PERSON NAMED IN COLUMN TWO | the state of the s | -        | -            | OATE     | Laborate Co. |        | DATE              | NAME | i  | THE GOLDO COOMICK  | Typ: 4010  |
|                                |  |          |              |          |              |        | The second second |      | and the state of t | and the second s |  |
|                                |  |          |              |          |              |        |                   |      |  |  | the state of the s |



| DW BLACK DI BLUE  DW BLACK DI BLUE  IN NED GI GREY  IN NED GI GREY  IN NOTE WA WHATE | 04           | 8028 , 62<br>\$028 , 95<br>\$028 , 93 | 2.6.78<br>16.10.75<br>30.9.75 | Kr.<br>Kr.<br>Kr. | popr<br>boarb. |      | May Kr.      | Schlumberger o/s | Frequenzzähler    | 237 002 S BL2 |
|--|--------------|---------------------------------------|-------------------------------|-------------------|----------------|------|--------------|------------------|-------------------|---------------|
| go VELLOW IT TRANSPARENT   | Aurg.<br>ISS | AMortig.<br>MOSSNF.                   | Detum<br>BATE                 | None<br>NAME      | 1975           | BATE | Nome<br>NAME | 8 Münchan 66     | FREQUENCY COUNTER | Тур: 4010     |







| Schaltplanpositionierung                    | £ 360                         | 080 Sa            | / 237 002 5   |
|---|-------------------------------|-------------------|---|
| 09 Romei  06  07  06  05  Werkstoff  04  03 | Freemail<br>1999r geryain     | 2:1               | Schlumberger o/s MeAgeratebal, verriet Gmbi- H Myncher 45 |
| O2<br>O1 TREE OF CAPUT Name                 | 76 Datum<br>ger 21 1<br>bears | Name<br>Lina D.S. | Bestückte Leiterplatte 350 080                            |

Diese Zeichnung st unter Expantum Verweitlichgung unterligte Verweinung Mittellung en endere ist erreiber und echedenereatzeflichtig

(See block circuit diagram 102 820 B for total instrument).

## 1. Type survey

| Instrument ser. number | Type of oscillators | Frequency ranges  | Number of sub oscillators |
|------------------------|---------------------|-------------------|---------------------------|
| 4010 4020              |                     |                   |                           |
| 012801 to 052850       | 213 012             | 60100 MHz         | 2                         |
|                        |                     | 140180 MHz        | 2                         |
|                        |                     | 420 480 MHz       | 1 (3 subranges)           |
| 062801 to062899        | 2130:15             | 60100 MHz         | 2                         |
|                        |                     | 140 180 MHz       | 2                         |
|                        | •                   | 420 480 MHz       | 1 (3 subranges)           |
| 072801 to 072882       | 213025]             | 60100 MHz         | 2                         |
| 072883 to              | 213 016             | 140180 MHz        | 2                         |
|                        |                     | 400 480 MHz       | 1 (2 subranges)           |
| 4010 A 4021            |                     |                   |                           |
| 052801 to 062899       | 213 013             | 40 200 MHz        | 9                         |
| 002001 to 002000       | 210010              | 420 480 MHz       | 1 (3 subranges)           |
|                        |                     | 420 400 WIIIZ     | 1 (3 sublanges)           |
| 072801 to 072882       | 213023              | 40 200 MHz        | 9                         |
| 072883 to              | 213 017             | 400 480 MHz       | 1 (2 subranges)           |
| 4011 4022              |                     |                   |                           |
|                        | 010010              |                   |                           |
| 062801 to062899        |                     | see 4010 A        | 4.4                       |
| an                     | d 213 014           | 200 420 MHz       | 11                        |
| 072801 to              | 213 017             | see 4010 A / 4021 |                           |
|                        | d 213 014           | see above         |                           |
|                        |                     |                   |                           |

|              | Function Description | 213 012 F        | Sheet 1/3  |
|--------------|----------------------|------------------|------------|
| Schlumberger | Type: 4020/21/22     | Oscillator Stage | Date 0 979 |

## 3. Oscillators

The frequency of the LC or power circuit can be tuned by at least 22 MHz by means of the varactor diodes, the necessary automatic phase control voltage from the decade stage controlling the oscillator frequency to the required value. Due to this very slow frequency control the FM modulation - and also the internal interference modulation - is not eliminated.

By means of additional varactor diodes each oscillator can be frequency modulated by the AF signal "FM(AC)". The adjustable coupling of the FM diode and the APC DC voltage compensates the RF response of the FM sensitivity.

The RF signal is provided to the output amplifier through to the buffer amplifer, harmonic low pass filter and the combination circuitry. To generate 40...60 MHz using a single oscillator circuit a double oscillator frequency of 80...120 MHz is generated and devided at the output by 2.

The oscillator frequency of the 420...480 MHz oscillator is adjusted by the switching diodes in 3 sub ranges (420...440, 440...460, 460...480 MHz).

## 2. Oscillator Selection

The digital frequency setting commands of the 10 MHz and 100 MHz decade are (after slightly code modification in the decade stage) applied to the oscillator selector, this supplying only the corresponding oscillator with +14 V. The switching diodes too of the RF combination are then either reversed or forward.

In the "transmitter frequency measurement" mode no oscillator is oscillating and the RF combination passes the transmitter signal rereived from the output stage to the output amplifier.

|              | Function | n Description | 213 012 F        | Sheet 2/3 |
|--------------|----------|---------------|------------------|-----------|
| Schlumberger | Type:    | 4020/21/22    | Oscillator Stage | Date 0979 |

## 4. Output Amplifier

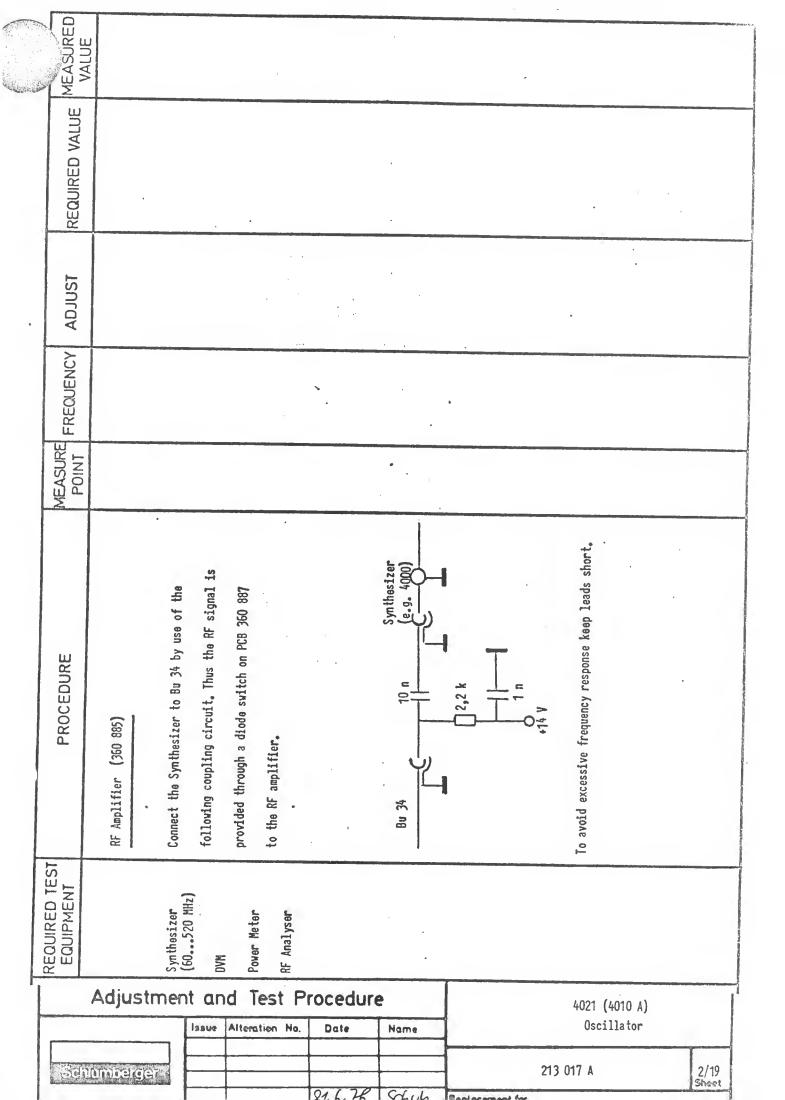
The RF rectifier in the amplifier output controls the constant output amplitude using the pindiode attenuator pad on the amplifier input.

The ALC control voltage exceeds the normal voltage range should the RF amplitude not be sufficient causing the counter to flash through the RF-ALC (DC) line.

The output amplifier has 2 RF outputs: for the output stage with frequency response and high level and for the decade stage with higher frequency response and low level.

|              | Function Description | 213 012 F        | Sheet 3/3 |
|--------------|----------------------|------------------|-----------|
| Schlumberger | Type: 4020/21/22     | Oscillator Stage | Date 0979 |

| MEASURED                |   |                             |
|-------------------------|---|-----------------------------|
| REQUIRED VALUE          | on*  **  **  **  **  **  **  **  **  **   |                             |
| ADJUST                  |   |                             |
| FREGUENCY               |   |                             |
| MEASURE                 | St 102/1  1/16  1/15  1/15  1/15  1/15  1/15  1/15  |                             |
| PROCEDURE               | Oscillator Selector (PCB 360 884)  Check, that only the oscillator appropriate to the frequency setting on front panel and to the following list is switched on.  Frequency setting.  40 49,99 WHz 50 59,99 WHz 60 79,99 WHz 100 179,99 WHz 160 179,99 WHz 160 179,99 WHz 160 179,99 WHz 160 179,99 WHz |                             |
| REQUIRED TEST EQUIPMENT | w MA  |                             |
|                         | Adjustment and Test Procedure    Issue   Alteration No.   Date   Name   | 4021 (4010 A)<br>Oscillator |
| Salu                    | imbe/ger  | 213 017 A 1/19              |



|        | MEASURED         | VALUE   |                                   | ,                     |  |                              |   | :  |  |                           |                             |
|--------|------------------|---|-----------------------------------|-----------------------|--|------------------------------|---|--|--|---------------------------|-----------------------------|
| ,      | REQUIRED VALUE   |   | Pout " +7,8 +9 d8m                | Pout = +8,8+10 d8m    | Pout * +10+12 d8m                              | P + 7,8+9 d8m                | Pout = +8,8,0,0+10 d8m Pout = +8+10 d8m | You < 11,5 y<br>VOC < 11,5 y<br>VOC > 11,5 y | - 2 16 d8m   | - 2 10 d8m                | 30 d8c                      |
|        | ADJUST           |   |                                   |                       |  |                              | r<br>Q                                  | 1  |  |                           |                             |
|        | FREGUENCY        |   | 60400 MHz                         | 400480 MHz            | 60480 MHz                                      | 50 MHz                       | 500 MHz                                 | 60500 MHz                                    | 20 60 MHz<br>60100 MHz   | 100480 MHz                | ZHU DOCC****                |
|        | MEASURE<br>POINT |   | 8u 35                             | 8u 35                 | 0F 10  | 8u 35                        | 8u 35                                   | DF 10  | 8u 40  | , a                       |                             |
|        | PROCEDURE        | RF Amplifier (360 885) - continued<br>Output Level on Bu 35 | P <sub>1N</sub> = -7 dBm on Bu 34 | PIN = -5 d8m on 8u 34 | OVM connected to OF 10 Automatic Level Control | P <sub>IN</sub> = +2 =12 d8m | P ** *2 *** * 6 d8m                     | Command Line: "RF present" "RF lacking"      | Output Level on Bu 40 P <sub>IN</sub> = -5 dBm on Bu 34 For this measurement a 50 A load must be connected | to Bu 35. Harmonic Output |                             |
|        | EQUIPMENT        |   | Synthesizer<br>(60520 MHz)        | MAO                   | Power Meter                                    |                              |   |  |  | RF Analyser               |                             |
| - Inch |                  | Adj   | ustn                              | nent d                |  |                              | ocedur                                  | Name   |  |                           | 4021 (4010 A)<br>Oscillator |

Adjustment and lest Procedure

| Second | Second

| UE MEASURED<br>VALUE    |                                      |  |  |                        |  |                                 |   | e en e yengengan |   |          |   |              | - |
|-------------------------|--------------------------------------|--|--|------------------------|--|---------------------------------|---|------------------|---|----------|---|--------------|---|
| REQUIRED VALUE          |                                      | 0 v  | A 0 0 V  |                        | 4  | 11,4 vuc<br>> 2 vuc             | 11,4 VOC<br>> 2 VOC   |                  |   |          |   |              |   |
| ADJUST                  |                                      |  |  |                        | 6  | 3                               | C2 <i>3</i>   |                  |   |          |   |              |   |
| FREGUENCY               |                                      | 400 MHz<br>440 MHz   | 440 MHz  |                        | - FM 0 0C-7  | 400 MHz                         | 479,9 MHz<br>440 MHz  |                  |   |          |   |              |   |
| MEASURE<br>POINT        |                                      | בב   | 123  |                        | 6  | all T-No                        | UR-Line   |                  |   |          |   |              |   |
| PROCEDURE               | 1. Oscillator Selector (PCB 360 889) | Set 440 MHz and check supply voltage at L1 Set 440 MHz and check at L1 | Set 440 MHz and check at L21<br>Set 480 MHz and check at L21 | 2. Frequency Alignment | Set 439,9 MHz. Press the TRANSMITTER MEASUREMENT button. Adjust C12, C32, R14, R34 to mid-position Adjust C7 to get 11.4 V on the No-1 ine [AFC] | Set 400 MHz and check AFC again | Set 479,9 MHz and adjust C27<br>Set 440 MHz and check again |                  |   |          |   |              |   |
| REQUIRED TEST EQUIPMENT | OC-Multimeter                        |  |  |                        |  |                                 |   |                  |   |          |   | ٠            |   |
|                         | Adjustme                             | ent (  | -  |                        | ocedur   | e<br>No                         | me  |                  |   | 4(       | 021 (40 <sup>.</sup><br><b>0</b> scilla | 10 A)<br>tor |   |
| 12-CC 2                 | umenear                              |  |  |                        | 20130  |                                 |   |                  | 2 | 13 017 / | ١                                       | 5 35         | 4 |

|   | MEASURED<br>VALUE  |   |   |   |   |  |  |   |  |  |               |  |
|---|--|---|---|---|---|--|--|---|--|--|---------------|--|
|   | REQUIRED VALUE   |   |   | 10 kHz dev. appr.                                       | exact value as above  | 10 khz 2 5 %   |  | 10 kHz dev. appr.                                       | exact value as above   | 10 kHz ± 5 %   |               |  |
|   | ADJUST   |   |   |   | C12   | R10  |  |   | C32  | R34  |               |  |
|   | FREQUENCY  |   |   | 400 MHz   | 439,9 MHz   | 400° 439,9 MHz   |  | 440 MHz   | 6,674  | 440 479,9 MHz  |               |  |
|   | MEASURE  |   |   | Mod.meter   |   | <b>6-</b>  |  |   |  | •  |               |  |
|   | PROCEDURE  | FM-Sensitivity Adjustment (PCB 350 089) | Set approx. 10 kHz frequency deviation. | Set 400 MHz and note deviation on the modulation meter. | Set 439,9 NHz and adjust C12 to get equal deviation as at 400 MHz | Adjust R10 to exact 10 kHz deviation<br>Check deviation at 2 MHz fraquency exacted | Cat 640 MHz and not of the cate of the cat | Set 770 MMZ and Mote Deviditor on the modulation meter. | Set 479,9 MHz and adjust C32 to get equal deviation as at 440 MHz. | Adjust R34 to exact 10 kHz deviation<br>Check deviation at 2 MHz frequency spacing |               |  |
|   | REQUIRED TEST<br>ECUIPMENT   | Modulation meter<br>Multimeter          |   | ,   |   |  |  |   |  |  |               | And the state of t |
|   | The second secon | Adjustm                                 | en                                      | t an  | d Tes   | t Pr   | ocedur   | 6   |  |  | 4021 (4010 A) | The select of the selection of the selec |
| 2 |  |   |   | lssue   | Alteration  | No.  | Date   | P   | lame   |  | Oscillator    |  |
|   | <b>ड</b> ली  | in liverger#                            |   |   |   |  | 04 ( 3 -   |   |  |  | 213 017 A     | 5/19<br>Sheet  |
|   | 1. July 19. 19. 19.  |   |   |   | ļ   |  | 21.6.76  | 1->   | chuh   | Rophoses   | ement for     | -  |

|  | MEASULED<br>VALUE |   |                                     |
|--|-------------------|---|-------------------------------------|
| n in (garanteen een een een een een een een een ee | REQUIRED VALUE    | 20A 9 >   | < 8 Hz/9 mRad                       |
| )  | ADJUST            |   |                                     |
|  | FRECUENCY         | 20  | 439,9 MHz<br>479,9 MHz              |
|  | MEASURE<br>POINT  |   |                                     |
|  | PROCEDURE         | Check OC-level on R39 (PCB 360 885)  Tip: To get an lower DC-level, pull C25, C5 towards transistor  Oscillating conditions  Interrupt the AFC-line (UR) and replace it by + 0,5 VDC. Chance FET if no oscillation occurs under this condition. | Check unwanted FM- and PM-deviation |
|  | EGUIPMENT         | Multimeter  | Modulation meter                    |
|  | the same of the   | Adjustment and Test Procedure  Issue Alteration No. Date N  | 4021 (4010 A) Oscillator            |
| S. entrance  | Selli             | Jinbergen Control   | 213 017 A 6/19<br>Sheet             |

|                          | 10                         | I   | ,   | er er vedens |                       |  |
|--------------------------|----------------------------|---|---|--------------|-----------------------|--|
|                          | MEASURED                   |   |   |              |                       |  |
| , her                    | REGUIRED VALUE             | < 1,5 %   | 80 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0                                |              |                       |  |
|                          | ADJUST                     |   |   |              |                       |  |
|                          | FREQUENCY                  | 400 479 MHz   | 1 kHz fmod<br>10 kHz fmod   |              |                       |  |
|                          | MEASURE<br>POINT           |   |   |              |                       |  |
|                          | PROCEDURE                  | FM-Distortion<br>Check FM distortion at 20 kHz deviation and 1 kHz f <sub>mod</sub> | AF-Frequency Response<br>Check frequency response at 10 kHz deviation |              |                       |  |
|                          | REQUIRED TEST<br>ECUIPMENT | Hod. Mater<br>Distortion Analyse  | AF Voltmeter  |              |                       | The state of the s |
|                          |                            | Adjustment and  | Test Proced   | ure          | 4021 <b>(</b> 4010 A) | A COA COMMENT SHOWN AS A SHOP  |
| ONCORPORATION CONTRACTOR |                            |   | Afterstian No. Date   | Name         | Oscillator            |  |
|                          | 2017                       | miegger   | (24 ( )   | e Greek      | 213 017 A             | 7/19<br>Sheet  |

| Section of the sectio | *OUT OT 011 OD0          |   | Recorded to the second |              |         |   |                   |
|--|--------------------------|---|---|--------------|---------|---|-------------------|
|  | EQUIPMENT                | PROCEDURE   | MEASURE FF<br>POINT   | FREGUENCY    | ADJUST  | REQUIRED YALUE                          | MEASURED<br>VALUE |
|  | A                        | Oscillator 40200 MHz (360 887) - continued  |   |              |         |   |                   |
| ustr<br>ege  | Counter                  | 2. 2 Miz Frequency Offset on TRANSM. MEASUREMENT  |   | ···          |         |   |                   |
| las  |                          | Depress: TRANSM, MEASUREPERT and fnoo   |   |              |         |   |                   |
| and Te   | 1 ~                      | (When checking without the Control and Display Unit, connect pin 21 of St 22 and OF 7 of the Decade Stage to ground). |   |              |         |   |                   |
| - f. m p m   |                          | Set decade switch to 49,999   | RF DIRECT   | 51,999       |         |   |                   |
| -  |                          | 966,965   | or su 33  | 61,999       |         |   |                   |
| edu<br>ate   |                          | 666,66  |   | 101,999      |         |   |                   |
|  |                          | 119,999 MHz   |   | 121,999 NHz  |         | V. C. (11.5 V                           |                   |
| lame   |                          | 139,999   |   | 141,999      |         | AFC =                                   |                   |
|  |                          | 159,999   |   | 161,999      |         |   |                   |
| 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  |                          | 179,999   |   | 181,999      |         |   |                   |
|  |                          | 199,999   |   | 201,999      |         |   |                   |
|  |                          | Check the "RF present" line at the same frequencies.  | 0F 10   | as above     |         | < 10,5 V                                |                   |
| 213 017  | Noise Deviation<br>Meter | 3. Noise Deviation FM   | RF DIRECT 40  | 40199,99 МНг |         | Noise Dev. < 8 Hz<br>CCITT weighted     |                   |
| 4021 (4010<br>Oscillato  |                          | QM:   |   |              | , L—,—, | Phase Dev. < 0,01 RAD<br>CCITT weighted |                   |
|  |                          |   |   |              |         |   |                   |
| 8/19   |                          |   |   |              |         | 3                                       |                   |
|  | -                        |   |   |              |         |   |                   |

| <ul> <li>40. MHz</li> <li>50 m</li> <li>60 m</li></ul> |
|--|
| <ul> <li>40. MHz</li> <li>50 B</li> <li>60 B</li> <li>700 B</li> <li>7120 B</li> <li>7130 B</li> <li>7130 B</li> <li>7130 B</li> <li>7140 B</li> <li>7150 B</li></ul>    |
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| The second second                      |  |  |  |                                       |  |  |  | and the same of th |
|--|--|--|--|---------------------------------------|--|--|--|--|
|  | and the same of th | REQUIRED TEST EQUIPMENT  | PROCEDURE  | MEASURE<br>POINT                      | FREQUENCY  | ADJUST                                   | REQUIRED VALUE   | MEASURED<br>VALUE  |
|  | Adj  |  | Oscillator 40200 FHz (360 837) - continued   |                                       |  |  |  |  |
| 949                                    | ustr   |  | 5. FM Sensitivity depending on Carrier Frequency   |                                       |  |  | January  |  |
|  | ment o   | AF Generator<br>DVM  | f mod = 1 kHz<br>V mod = 3 * 0.05 V ms on St 51/1 or on OF 11  |                                       |  |  | and the second s |  |
|  |  | (Deviation Meter calibrated by   | 40 50 Miz Band   |                                       |  |  |  |  |
| 00 15                                  | Test   | means of the<br>Bessel function)   | Adjust deviation at both ands of the band  | RF DIRECT<br>or Bu 35                 | 40,0 MHz<br>49,999 MHz   | R 2 R 12                                 | ∆f ≈ 20 kHz<br>∆f ≈ 20 kHz   |  |
| 74 (                                   |  |  | Check deviation across whole band in 1 MHz steps.  If necessary, adjust R 2 for equal positive and   | 1                                     |  | rnatively                                | en e   |  |
|  |  |  | negative deviation accuracy.   |                                       | 4049,999 FIHZ  | R 12                                     | Accuracy = 3%  |  |
|  | re<br>Name   |  | If adjusting to the specified accuracy † 3% is not possible across entire band, the oscillator tuning (L 1) must be changed. Simultaneously the AFC-potential must be observed and kept within limits. |                                       | ,  |  |  |  |
|  |  |  | Setting: RECEIVERMEASUREMENT   | RF DIRECT                             | ZHW 07   |  | VAFF < 2,5 V   |  |
| ************************************** |  |  | TRANSHITTERMEASUREMENT   | and<br>AFC-line                       | ZHM 6°617  |  | VAFC <11,5 V   |  |
| 21                                     |  |  |  | · · · · · · · · · · · · · · · · · · · |  |  |  |  |
| 3 017 A                                |  |  |  | (ArC-line =<br>grey lead)             |  | e en |  |  |
|  | )21 <b>(</b> 401<br>)scilla  |  |  |                                       |  |  |  |  |
|  |  |  |  |                                       |  |  |  |  |
| 10/19<br>Sheat                         |  |  | ,  |                                       |  |  | Marie de La companya   |  |
|  | Commence of the second  | THE RESIDENCE OF THE PARTY OF T |  |                                       | The second secon |  |  |  |

9028 15

| MEXSURED                   |  |               |   |   |   | PACSONIA CONTINUES           |                        |            |                          |                         |           | Partie Control       |
|----------------------------|--|---------------|---|---|---|------------------------------|------------------------|------------|--------------------------|-------------------------|-----------|----------------------|
| REQUIRED VALUE             |  |               | Δf = 20 kHz<br>Δf = 20 kHz                | Accuracy * 3%   |   | VAFC < 2,5 V                 | VAFC <11,5 V           |            |                          |                         | ·         |                      |
| ADJUST                     |  |               | R 72 R 63 alternatively                   | R 72  |   | 111                          | 11 -                   |            |                          |                         | ٠         | Pandingsyntrological |
| FREGUENCY                  |  |               | 50,0 NHz<br>59,9 MHz                      | 5059,9 MIZ  |   | 50,0 MHz                     | 59,9 MIZ               |            |                          |                         |           |                      |
| MEASURE                    |  |               | RF DIRECT<br>or Bu 35                     | 92  |   | RF DIRECT                    | AFC-line               |            | (AFC…linem<br>grey lead) |                         |           |                      |
| PROCEDURE                  | Oscillator 40200 MHz (360 887) - continued | 5060 MHz Band | Adjust deviation at both ends of the band | Check deviation across whole band in 1 MHz steps.<br>If necessary, adjust R 72 for equal positive and<br>negațive deviation accuracy. | If adjusting to the specified accuracy * 3% is not possible across entire band, the oscillator tuning (L 11) must be changed. Simultanoously the AFC-potential must be observed and kept within limits. | Setting: RECEIVERMEASUREMENT | TRANSMITTERMEASURENENT |            |                          |                         | •         |                      |
| REQUIRED TEST<br>EQUIPMENT |  |               | Dev. Noter<br>AF Generator<br>DVM         |   |   |                              |                        |            |                          |                         |           | Age of the second    |
|                            | Adju                                       | stme          |   | Test P  | rocedure  | Name                         |                        |            |                          | 4021 (4010<br>Oscillato |           |                      |
|                            | fiera (A                                   |               |   |   | 21.6.76   | Chul                         | n Rep                  | lacement f | 213 0                    | 17 A                    | 11/<br>5h |                      |

A. Washing

|               | MEASURED<br>VALUE |  |                |   | Tao Marin Ingala Sanagan Ing   |  |                              |                        |                          |                          |  |
|---------------|-------------------|--|----------------|---|--|--|------------------------------|------------------------|--------------------------|--------------------------|--|
|               | REQUIRED VALUE    |  |                | Of = 20 kHz<br>Of = 20 kHz                |  | Accuracy ~ 3,6   | VACC < 2,5 V                 | VAFC <11,5 V           |                          |                          |  |
|               | ADJUST            |  |                | R 172                                     | R 172  | •  | 1 43                         | C +3                   |                          |                          |  |
| E             | FREQUENCY         |  |                | 60,0 MHz<br>79,9 MHz                      | 6079.9 MIZ   |  | 60,0 MHz                     | 79,9 Mrz               |                          |                          | and the state of t |
| MEASURE       | POINT             |  |                | RF DIRECT<br>or Bu 35                     | Re*  | •  | RF DIRECT                    | AFC-line               | (AFC-line=<br>grey lead) |                          |  |
| PROCEDINE     | מברחסאם.          | Oscillator 40200 MHz (360 887) - continued | 6080 Hitz Band | Adjust deviation at both ends of the band | Check deviation across whole band in 2 steps.<br>If nocessary, adjust R 172 for equal positive and<br>negative deviation accuracy. | If adjusting to the specified accuracy * 3% is not possible across entiro band, the oscillator tuning (L43) must be changed. Simultaneously the AFC-potential must be observed and kept within limits. | Satting: RECEIVERMEASUREMENT | TRANSMITTERMEASUREMENT |                          |                          | THE PARTY OF THE P |
| REQUIRED TEST |                   |  |                | Dav. Mater<br>Counter<br>DVM              |  |  |                              |                        |                          |                          | Social Section A General Section Company of the Compan             |
|               |                   | djust                                      |                | t and T                                   | 2  | Cedure  Date Mem   | e                            |                        | 213 01                   | 4021 (4010<br>Oscillator | A) 12/19 Short   |

| MEALURED                   | VALUE                                      |                |   | ,  | ed production and a single contract of the con |                              |                        |                             |                    |
|----------------------------|--|----------------|---|--|--|------------------------------|------------------------|-----------------------------|--------------------|
| REQUIRED VALUE             |  |                | ∆f = 20 kHz<br>∆f = 20 kHz                | Accuracy - 3%  |  | VAFC < 2,5 V                 | VAFC <11,5 V           |                             | ПР населения части |
| ADJUST                     |  |                | R 233                                     | alternativoly R 231  |  | 1 55                         | 1 55                   |                             |                    |
| FREQUENCY                  |  |                | 80,0 N Hz<br>99,9 MHz                     | 8099,9 MHz   |  | 80,0 MHz                     | 2HI 6 66               |                             |                    |
| WEASURE<br>POINT           |  |                | RF DIRECT<br>or 80 35                     | E  |  | RF DIRECT                    | and<br>AFC⊸lino        | (AFC-line=<br>grey lead)    |                    |
| PROCEDURE                  | Oscillator 40200 MHz (360 887) - continued | 80100 NHz Band | Adjust deviation at both ends of the band | Check deviation across whole band in 2 stops. If necessary, adjust R 231 for equal positive and negațivo deviation accuracy. | If adjusting to the specified accuracy - 3% is not possible across entire band, the oscillator tuning (L 55) must be changed. Simultaneously the AFC-potential must be observed and kcpt within limits.  | Setting: RECEIVERMEASUREMENT | TRANSMITTERMEASUREMENT |                             |                    |
| REQUIRED TEST<br>EQUIPMENT |  |                | Dev. Meter<br>Counter                     |  |  |                              |                        |                             |                    |
|                            | Adjus                                      | stmen          |   | Test P   | rocedure   | Name                         |                        | 4021 (4010 A)<br>Oscillator |                    |
| 1000                       | तिपालस्य                                   | <u></u>        |   |  | 21.6.76  | Solice                       | 04                     | 213 017 A Replacement for   | 13/19<br>Sheet     |

|                | 7/2/4                     | REOL   | REOLIBED TEST  |   |                              |                        | ,                   |                            |  |
|----------------|---------------------------|--|--|---|------------------------------|------------------------|---------------------|----------------------------|--|
| (dai)          |                           |  | EQUIPMENT  | PROCEDURE   | MEASURE                      | FREQUENCY              | ADJUST              | REQUIRED VALUE             | MERCOAE  |
| Ment Gray      |                           | Adjus  |  | Oscillator 40200 MHz (360887) - continued   |                              |                        |                     |                            | VALUE  |
| ên.            |                           | tmer   |  | 100120 HHz Band   |                              |                        |                     |                            |  |
|                |                           |  | Oev. Meter<br>Counter<br>NVM   | Adjust deviation at both ends of the band   | RF DIRECT<br>or Bu 35        | 100,0 MHz<br>119,9 MHz | R 233               | ∑f = 20 kHz<br>∑f = 20 kHz |  |
|                | Iteration No.             |  |  | Check deviation across whole band in 2 MHz steps.  If necessary, adjust R 233 for equal positive and negative deviation accuracy.   | 85                           | 100119,9 NHz           | alternatively R 233 | Accuracy + 3%              |  |
| 21.6.H         |                           | Procedure  |  | If adjusting to the specified accuracy * 3% is not possible across entire band, the oscillator tuning (L 61) must be changed. Simultaneously the AFC-potential must be observed and kept within limits. |                              |                        |                     |                            |  |
| Sauh R         | Name                      |  | ,  | Sotting: RECEIVERMEASUREMENT  TRANSMITTERMEASUREMENT  | RF OIRECT<br>and<br>AFC-line | 100,0 MHz<br>119,9 MHz | 197                 | VAFC < 2,5 V               |  |
| eptocement     |                           |  |  |   |                              | 3                      |                     |                            |  |
| 213 0          |                           |  |  |   | (AFC_line-<br>groy lead)     |                        |                     |                            | ,  |
| 17 A           | 4021 (4010 A<br>Oscillato | 1004 / 1000  |  |   |                              |                        |                     |                            |  |
| 14/19<br>Sheet |                           | And the second s | Control of the Contro |   |                              |                        |                     |                            | and design report to the second and design report to the secon |

| MEASURED                   |  |                  | _   |  | The second secon |                              | romodestinos.          |            |                          |             |                     |             |                |
|----------------------------|--|------------------|---|--|--|------------------------------|------------------------|------------|--------------------------|-------------|---------------------|-------------|----------------|
| REQUIRED VALUE             |  |                  | △ f = 20 kHz<br>△ f = 20 kHz              | Accuracy \$ 3%   |  | VAFC ≤ 2,5 V                 | VAFC <11,5 V           |            |                          |             |                     |             |                |
| ADJUST                     |  |                  | R 292                                     | tively   |  | £ 65                         | r 65                   |            |                          |             |                     |             | Providence     |
| E FREGUENCY                |  |                  | T 120,0 MHz 139,9 MHz                     |  |  | T 120,0 MHz                  | 139,9 MHz              | •          |                          |             |                     |             |                |
| WEASURE                    |  |                  | 'RF DIRECT<br>or Bu 35                    | GE .   |  | RF DIRECT                    | AFC-line               |            | (AFC-line-<br>grey lead) |             |                     |             |                |
| PROCEDURE                  | Oscillator 40200 MHz (360 887) - continued | 120 140 Miz Band | Adjust deviation at both ends of the band | Check deviation across whole band in 2 MHz steps. If necessary, adjust R 292 for equal positive and negative deviation accuracy. | If adjusting to the specified accuracy * 3% is not possible across entire band, the oscillator tuning (L 65) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.  | Setting: RECEIVERMEASUREMENT | TRANSMITTERMEASUREMENT |            |                          |             |                     |             |                |
| REQUIRED TEST<br>EQUIPMENT |  |                  | Dev. Moter<br>Counter                     | NA G   | ir.  |                              |                        |            |                          |             | •                   |             | figure em der- |
| 2000                       | Adju:                                      | stme             | nt an                                     | d Test F   | Procedure  | Name                         |                        |            |                          | 4021<br>Osc | (4010 A)<br>illator |             |                |
| 531                        |  | gen/             |   |  | 21.6.76  | Saro                         |                        | Raples eme | •                        | 3 017 A     |                     | 15/1<br>รกร | 9              |

| MEXSURED                   | VALUE       |  |                 |   |  |   |  |                          |                                |                |
|----------------------------|-------------|--|-----------------|---|--|---|--|--------------------------|--------------------------------|----------------|
| REQUIRED VALUE             | - 6         |  |                 | ∆f = 20 kHz<br>∆f = 20 kHz                | Accuracy * 3%  |   | V <sub>AFC</sub> ≤ 2,5·V·····<br>V <sub>AFC</sub> ≤11,5 V····· |                          |                                |                |
| ADJUST                     |             |  |                 | R 114 R 123                               | alternatively R 114  |   | L 33 —   |                          |                                | o              |
| FREQUENCY                  |             |  |                 | 140,0 MHz<br>159,9 MHz                    | 140159,9 MHz   |   | 140,0 NH2  | •                        |                                |                |
| MEASURE                    | L<br>N<br>N |  |                 | RF CIRECT<br>or Bu 35                     | 8  |   | RF DIRECT<br>and<br>AFC-line                                   | (AFC-line-<br>grey lead) |                                |                |
| PROCEDURE                  |             | Oscillator 40200 MHz (360 887) - continued | 140160 PHz Band | Adjust deviation at both ends of the band | Check deviation across whole band in 2 MHz steps. If necessary, adjust R 114 for equal positive and negative deviation accuracy. | If adjusting to the specified accuracy - 3% is not possible across entire band, the oscillator tuning (L 33) must be changed. Simultaneously the AFC-potential must be observed and kept within limits. | Setting: RECEIVERNEASURENENT TRANSMITTERMEASUREMENT            |                          |                                |                |
| REQUIRED TEST<br>EQUIPMENT |             |  |                 | Dev. Meter<br>Counter                     | 5  |   |  |                          |                                |                |
|                            | A           | dju  | stme            | ent ar                                    | nd Test  | Procedu   |  |                          | 4021 (401<br><b>0</b> scillate |                |
| 3                          | elun        | nloe                                       | ge a            |   | CHUTUINI   | Data  | Name   |                          | 213 017 A                      | 16/19<br>Sheet |
| Byle "The                  | A SEA       | Salah mark                                 |                 |   |  | 24.6.76   | Schoh  | Replacement for          |                                | Sheet          |

| MEASURED<br>VALUE          |  |                 |   |  |   |                              |                        |               |                                  |                             |  |
|----------------------------|--|-----------------|---|--|---|------------------------------|------------------------|---------------|----------------------------------|-----------------------------|--|
| REQUIRED VALUE             |  |                 | ∆f = 20 kHz<br>∆f = 20 kHz                | Accuracy - 3%  |   | VAFC < 2,5 V                 | VAFC <11,5 V           |               |                                  |                             |  |
| ADJUST                     |  |                 | R 165                                     | alternatively R 165  |   | LM                           | 14 14                  |               |                                  |                             |  |
| FREQUENCY                  |  |                 | 160,0 MHz<br>179,9 MHz                    | 160179,9 MHz   |   | 160,0 MHz                    | 179,9 MHz              |               |                                  |                             |  |
| MEASURE                    |  |                 | RF DIRECT<br>or Bu 35                     | •  |   | RF DIRECT                    | AFC-line               |               | (AFC-line-<br>grey lead)         |                             |  |
| PROCEDURE                  | Oscillator 40200 MHz (360 887) - continued | 160180 MYz Band | Adjust deviation at both ends of the band | Check deviation across whole band in 2 MHz stops.<br>If necessary, adjust R 165 for equal positive and<br>negative deviation accuracy. | If adjusting to the specified accuracy \$\frac{*}{2}\%\$ is notenssible across entire band, the oscillator tuning (L 41) must be changed. Simultaneously the AFC-potential must be observed and kept within limits. | Setting: RECEIVERHEASUREPENT | TRANSMITTERHEASUREMENT |               |                                  |                             |  |
| REQUIRED TEST<br>EQUIPMENT |  |                 | Dav. Meter<br>Counter                     |  |   |                              |                        |               | rite i en el casacama, sin e cel |                             | WOOD and were according to country of the first Annual Cou |
|                            | Adjus                                      | stme            | 47  | d Test F   | rocedur   | e<br>Nam                     | 8                      |               |                                  | 4021 (4010 A)<br>Oscillator |  |
| (0)                        | धार्वाच्या                                 | 261             |   |  | 21.6.76   | Schi                         |                        | Replacement f | 213 (                            | 017 A                       | 17/19<br>Sheet   |

| MEASURED<br>VALUE       |  |   |   | :   |                                 |   |
|-------------------------|--|---|---|---|---------------------------------|---|
| REQUIRED VALUE          |  | △ f = 20 kHz<br>△ f = 20 kHz  |   | VAFC < 2,5 V<br>VAFC <11,5 V                        |                                 | ·   |
| ADJUST                  |  | R 81 R 91 alternatively R 81  |   | 1.25  |                                 |   |
| FREQUENCY               |  | 180,0 MHz<br>199,9 MHz<br>180,2,199,9 MHz   |   | 180,0 NHz<br>199,9 MHz                              |                                 | 1   |
| MEASURE                 |  | RF DIRECT or Bu 35  |   | RF CIRECT<br>and<br>AFC-line                        | (AFC-line-<br>grey lead)        |   |
| PROCEDURE               | Oscillator 40200 MHz (360 887) - continued 180200 MHz Band | Adjust deviation at both ends of the band Check deviation across whole band in 2 MHz steps. If necessary, adjust R 81 for equal positive and negative deviation accuracy. | If adjusting to the specified accuracy - 3% is not possible across entire band, tho oscillator tuning (L 25) must be changed. Simultaneously the AFC-potential must be observed and kept within limits. | Setting: RECEIVERNEASUREMENT TRANSMITTERMEASUREMENT |                                 |   |
| REQUIRED TEST EQUIPMENT |  | Osv. Mater<br>Counter<br>DVM  |   |   |                                 | THE THE PERSON NAMED IN COLUMN TO SERVICE AND SERVICE |
|                         | Adjustme   | ent and Tes   |   | re<br>Name  | 4021 (4010<br><b>0</b> scillato | A)  |
| 305                     | lumbager   |   | 21.6.76   | Schoh   | 213 017 A Replacement for       | 18/19<br>Sheet  |

| MEASUREI<br>VALUE          |  |                             |
|----------------------------|--|-----------------------------|
| REQUIRED VALUE             | 0ist <sub>o</sub> < 7,5 %<br>at △ f = 10 kHz<br>> 30 dBe   |                             |
| ADJUST                     | 0 C C C C C C C C C C C C C C C C C C C  |                             |
| FREQUENCY                  | 40199 MHz  |                             |
| MEASURE                    | RF DIRECT or Bu 35   |                             |
| PROCEDURE                  | Oscillator 40200 MHz (360 887) - continued  6. Nodulation Distortion  frod = 1 kHz  Vand = 1.5 Vras on St 51/1 or on DF 11  7. Harmonics |                             |
| REQUIRED TEST<br>EQUIPMENT | Deviation Meter Distortion Meter RF Analyser 1200 MHz  | ·                           |
|                            | Adjustment and Test Procedure  Issue Alteration No. Date Name  | 4021 (4010 A)<br>Oscillator |

21.6.76 Shuh

Sedunder Gera

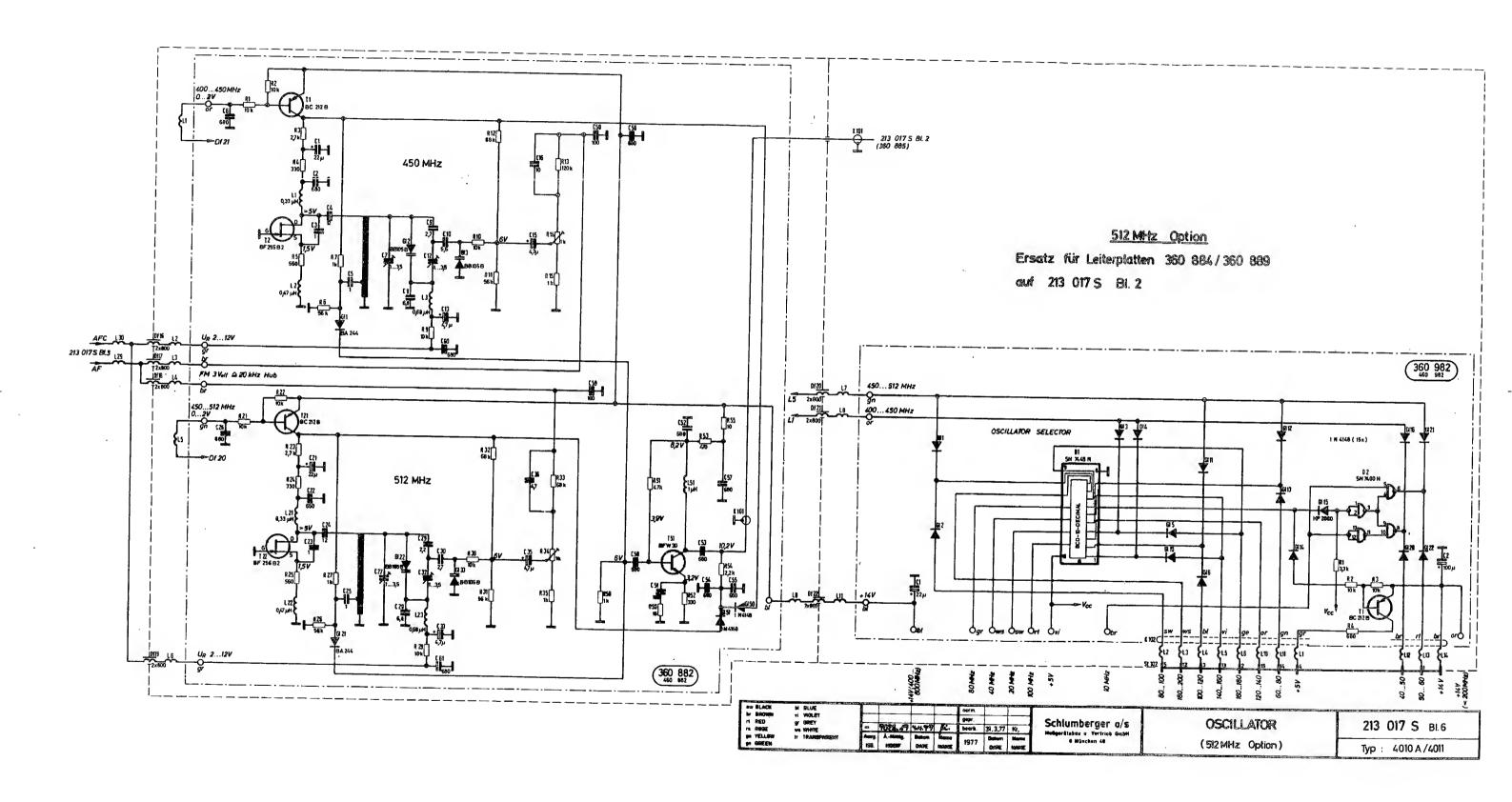
19/19 Sheet

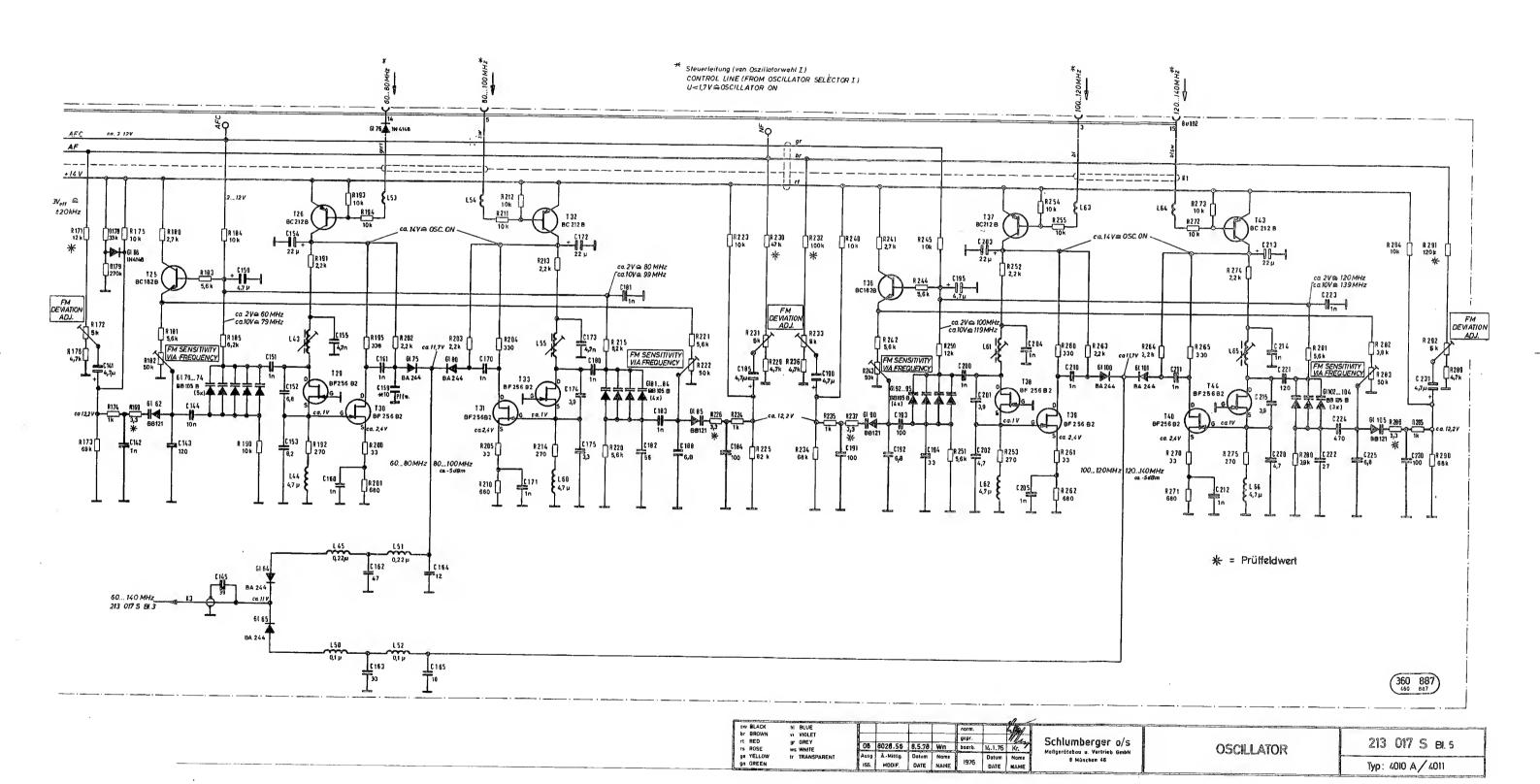
213 017 A

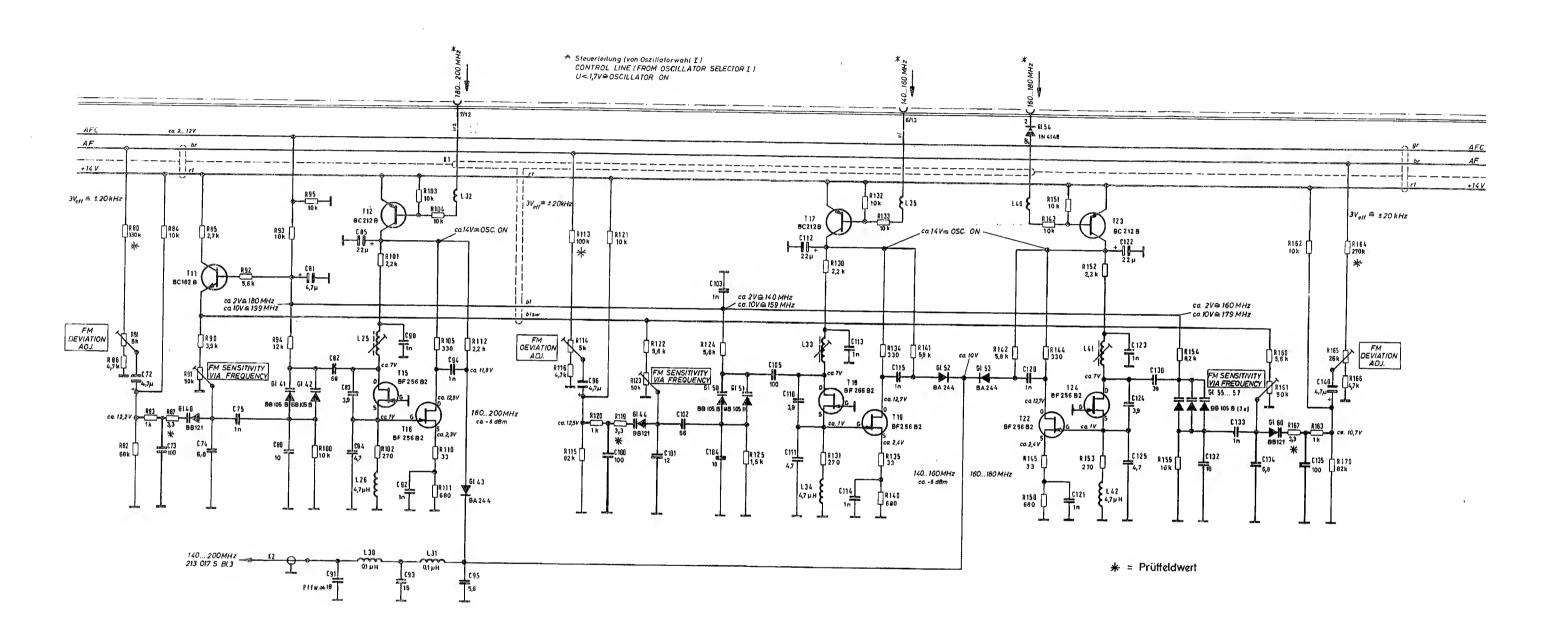
Replacement for

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C7/C12/C27/C32

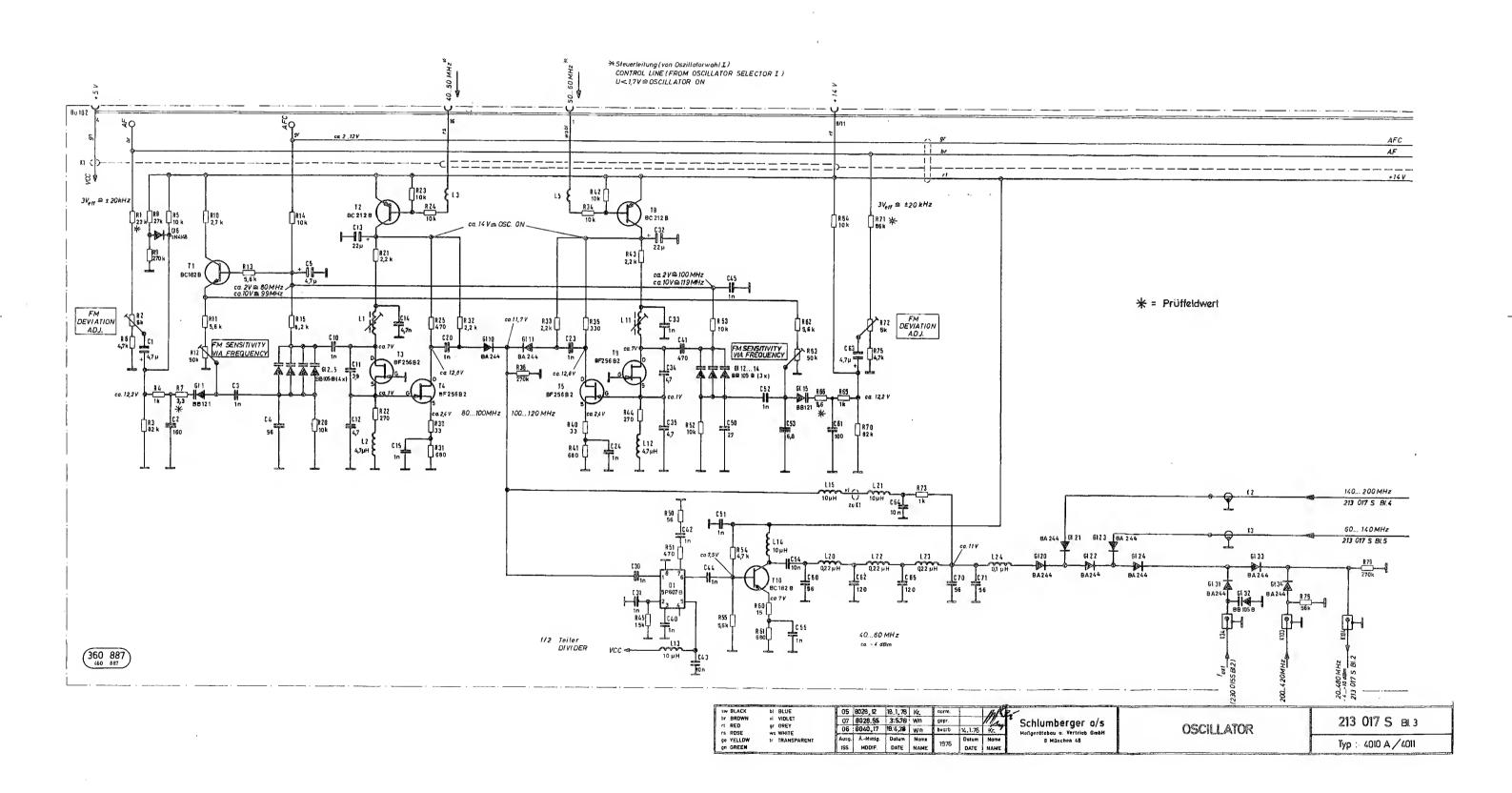


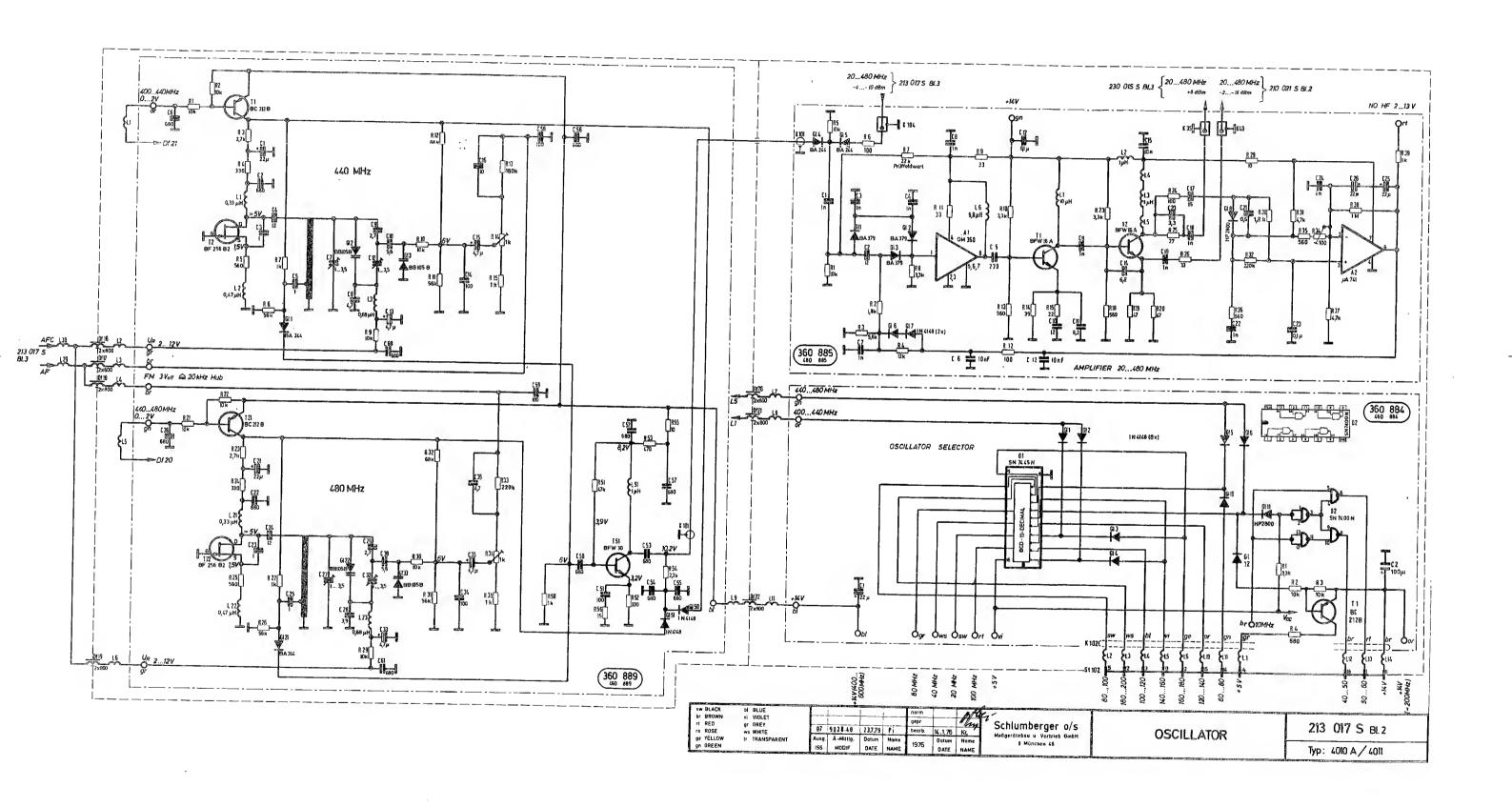


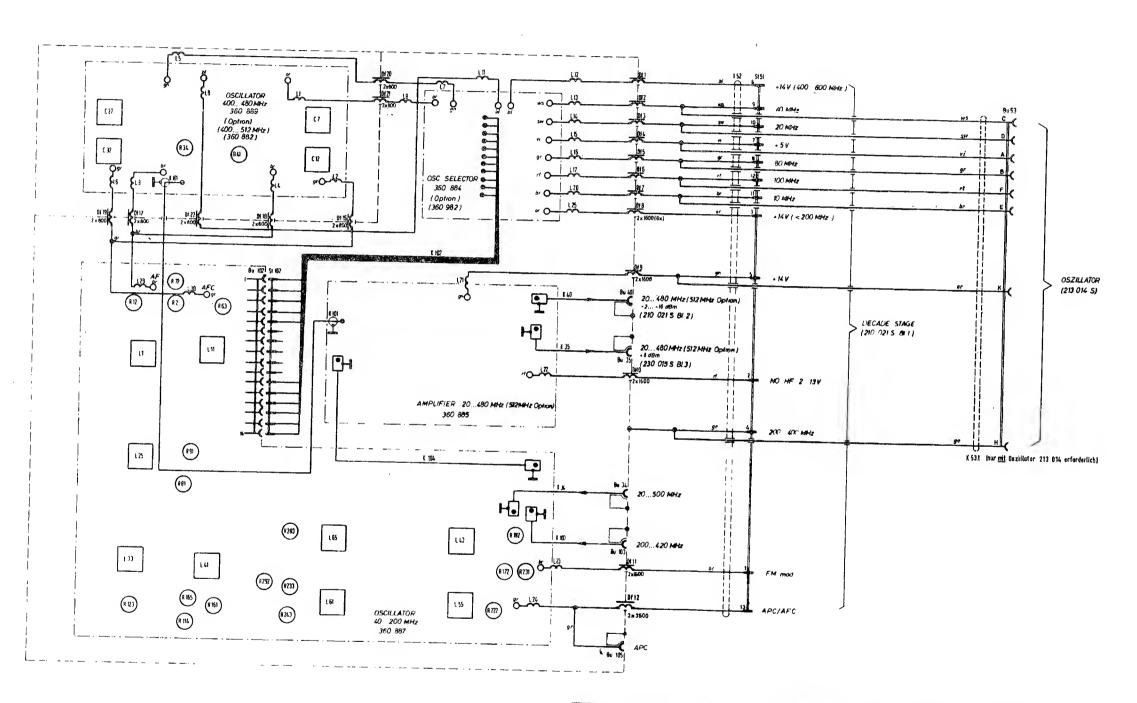


360 887 460 887

| sw BLACK bi BLUE br BROWN vi VIOLET rl RED gr GNEY rs ROSE ws WHITE gw VELLOW tr TRANSPARENT gn GREEM  |             | 9028.76 | <br>- | narm<br>gapr.<br>bearb. | 14,1.76<br>Datum | May<br>Kr.<br>Name | Schlumberger o/s Mongoratabou v. Vertrieb GmbH 8 München 46  | OSCILLATOR   | 213 017 S Bl. 4 |   |
|--|-------------|---------|-------|-------------------------|------------------|--------------------|--|--|-----------------|---|
| the state of the second place of the state of the second s | The same of | -       | <br>  | acert de parce          | -                |                    | the same from the same and the same of the | The second secon |                 | ı |



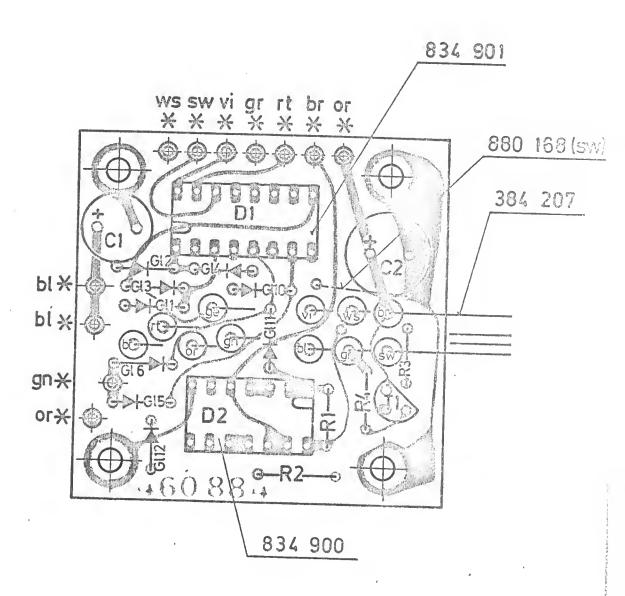




|   | The second second second      |                              | A. Timer harden to a |         |          |                      |            |                  |
|---|-------------------------------|------------------------------|----------------------|---------|----------|----------------------|------------|------------------|
| ı | S# BLACK<br>BFOWN             | bi BLUE<br>vi VIOLET         |                      |         | no-m     |                      |            |                  |
| l | ** RED<br>* ROSE<br>us fellow | gr GREY WS WHITE TRANSPARENT | 03 9028.63 12        |         | nears 14 | <br>Schlumberger o s | 0SCILLATOR | 213 017 S Bt 1.  |
| Ţ | yr GREEN                      |                              | ISS MODIF DA         | TE NAME | /b DAT   | <br>v Mygriph už     |            | Typ 4010 A, 4011 |

Gerat 4010 / 4011 / 4020

weich gelötet

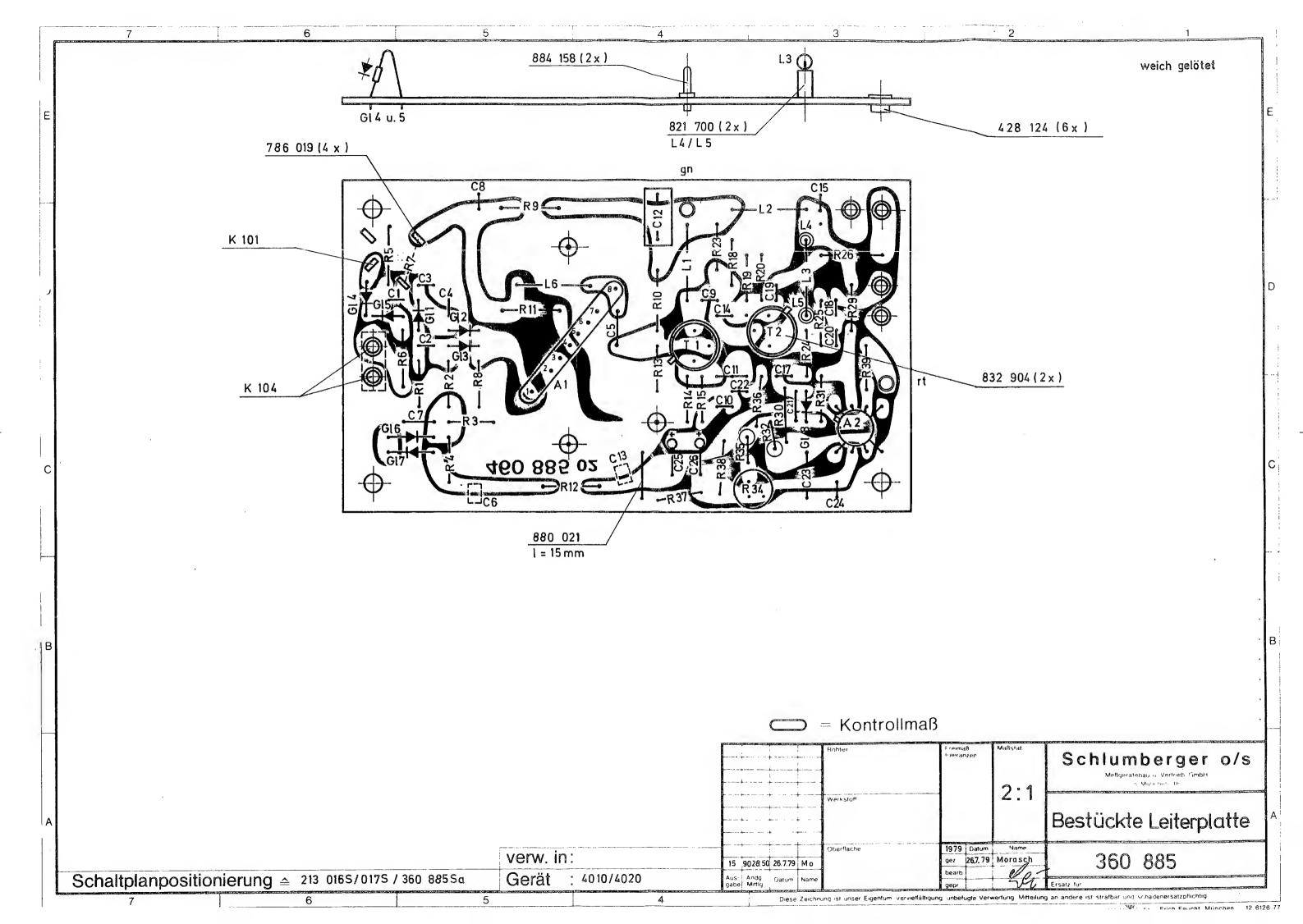


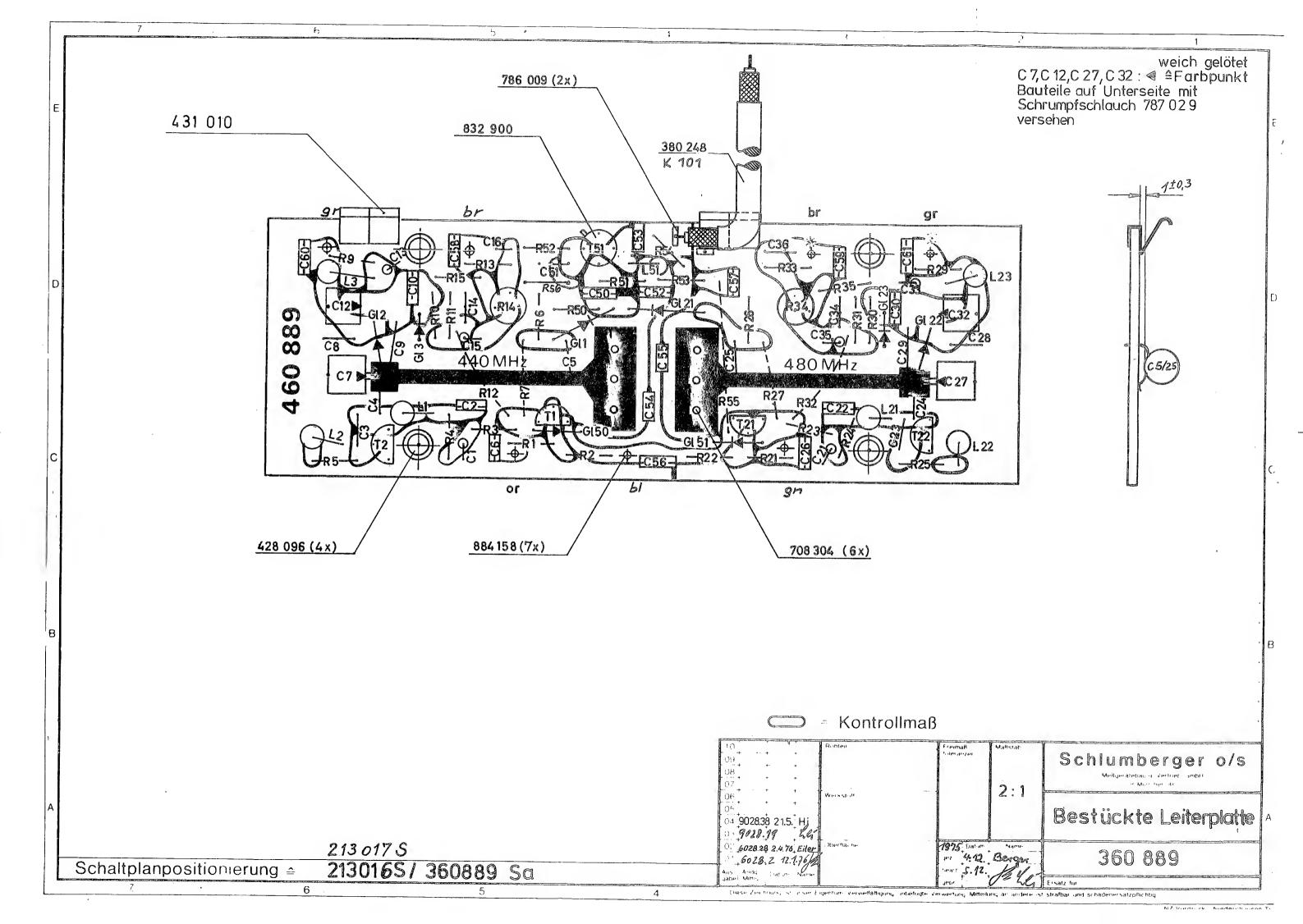
# \* = Farbpunkt

Schaltplanpositionierung ≥ 213 016 S / 213 017 S 360 884 Sa

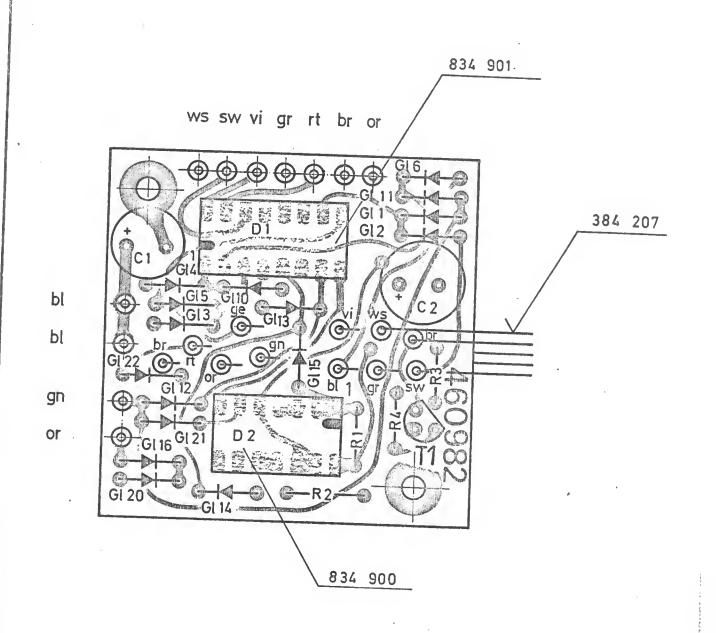
| 09                          | Rohteil Werkstoff | Freimaß toleranzen                     | Masstab       | Schlumberger 0/8 Meßgeråtebau u Vertrieb GmbH 8 Munchen 45 |
|-----------------------------|-------------------|--|---------------|--|
| 04 602847 22676 Filer<br>03 |                   | ± 0,2                                  | 4. [          | Bestückte Leiterplatte                                     |
| O1  Aus Andg Datum Name     | Oberfläche        | 1976 Datum<br>gez 22.6.<br>bearb 24.6. | Name<br>Filer | 360 884  |

ייתוחיייות שחבית שישיש אלגינוסגות ביתינטוומיוסניסעי שנוחסגיס אפניט ופי מתנייראש בפפונ!





weich gelötet



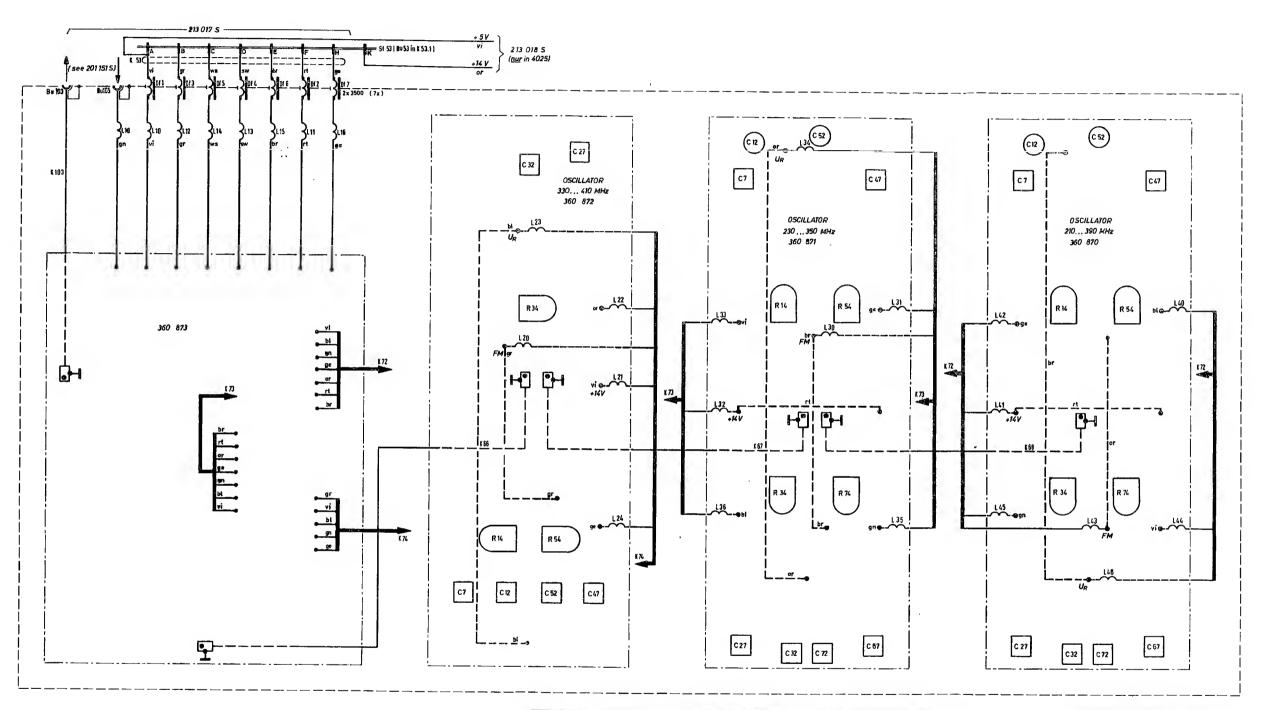
| 08   Ronteil   Ronteil   | Freimaß Maßsta tolleranzen 2: | Schlumberger o/s       |
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| 04<br>03<br>02 <b>9024</b> 4712.12.79 <b>%</b><br>01 Obertache |                               | Bestückte Leiterplatte |
| Aug. Acada Datum Name.   | 1979 13.12 79 Morasch         |                        |

|               | E MEASURED VALUE |  |  |   |   |   |
|---------------|------------------|--|--|---|---|---|
|               | REQUIRED VALUE   | > 5 VDC<br>>> 5 VDC  | > 10 VDC<br>< 1 VDC<br>< 1 VDC   | > 10 VDC<br>:< 1 VDC<br>< 1 VDC   | 10 VDC  | 10 VDC  |
|               | ADJUST           |  |  |   | C 47 / 360 870  | C 47 / 360 871<br>c 7 / 360 872   |
|               | FREQUENCY        | 210 MHz<br>230 MHz<br>250 MHz<br>410 MHz   | 200-<br>419,9 MHz<br>< 200 MHz<br>> 420 MHz                                      | 200 M1z<br>300 M1z<br>400 M1z   | Z19,999 MHz   | 239,999 MHz<br>:<br>419,999 MHz   |
|               | MEASURE          | L 44   |  | T2/Ermitter<br>"  | (1)<br>on<br>360 872  | -   |
|               | PROCEDURE        | 1. Oscillator Selector (PC Boards 360 870, 871, 872) Set Frequency 210 MHz end check supply Voltage at L 41 (360 870) Chance frequency in 20 MHz steps and check voltage at corresponding points of the other sub oscilletors. | Check DC-voltage at the middle conducter of the RF-cable K 103 (R 10 on 360 873) | 3. Low pass filter change over (360 873) Set 200 MHz, and check potential of Emitter of T 2. Change frequency | 4. Frequency Alignment (360 870, 71, 72)  Adjust trimmer capacitors C 12, C32 C 62 to mid-position. Select the RECEIVER MEASUREMENT mode. Set 219, 999 MHz and adjust C 47 to get 10 V on the U <sub>R</sub> -Line (AFC). | Change frequency in steps of 20 MHz and adjust trimmer capacitors of the other sub oscillators in the same way. |
| PEN HOED TECT | EQUIPMENT        | DVM<br>Mulimeter   |  |   |   |   |
|               |                  | djustment and Te   |  | re<br>Name  | 4022 (4011)<br>Oscillator   |   |
|               | Schlu            | mberger  | 5. 10.7  |   | 213 014 A   | 1/3<br>Sheet  |

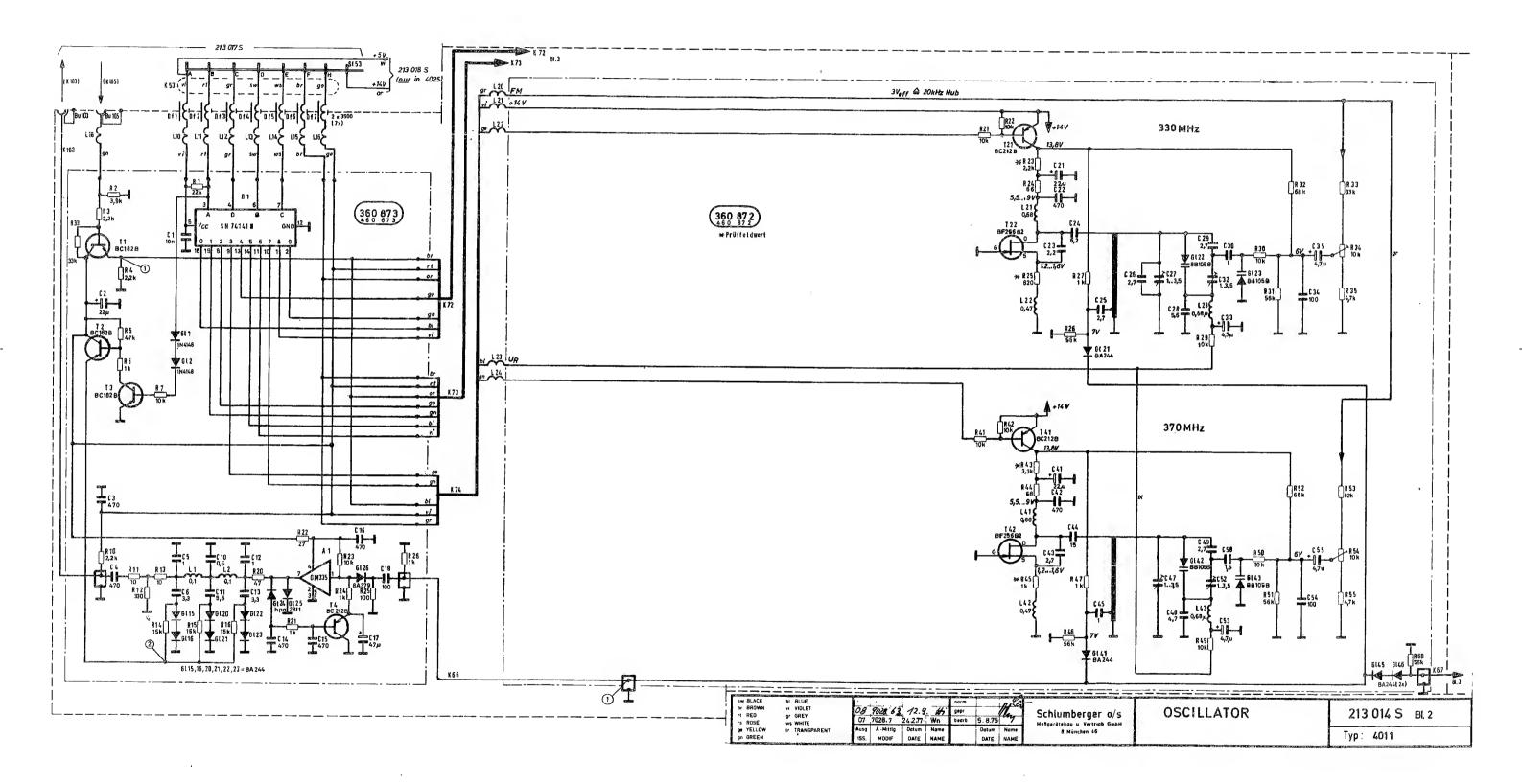


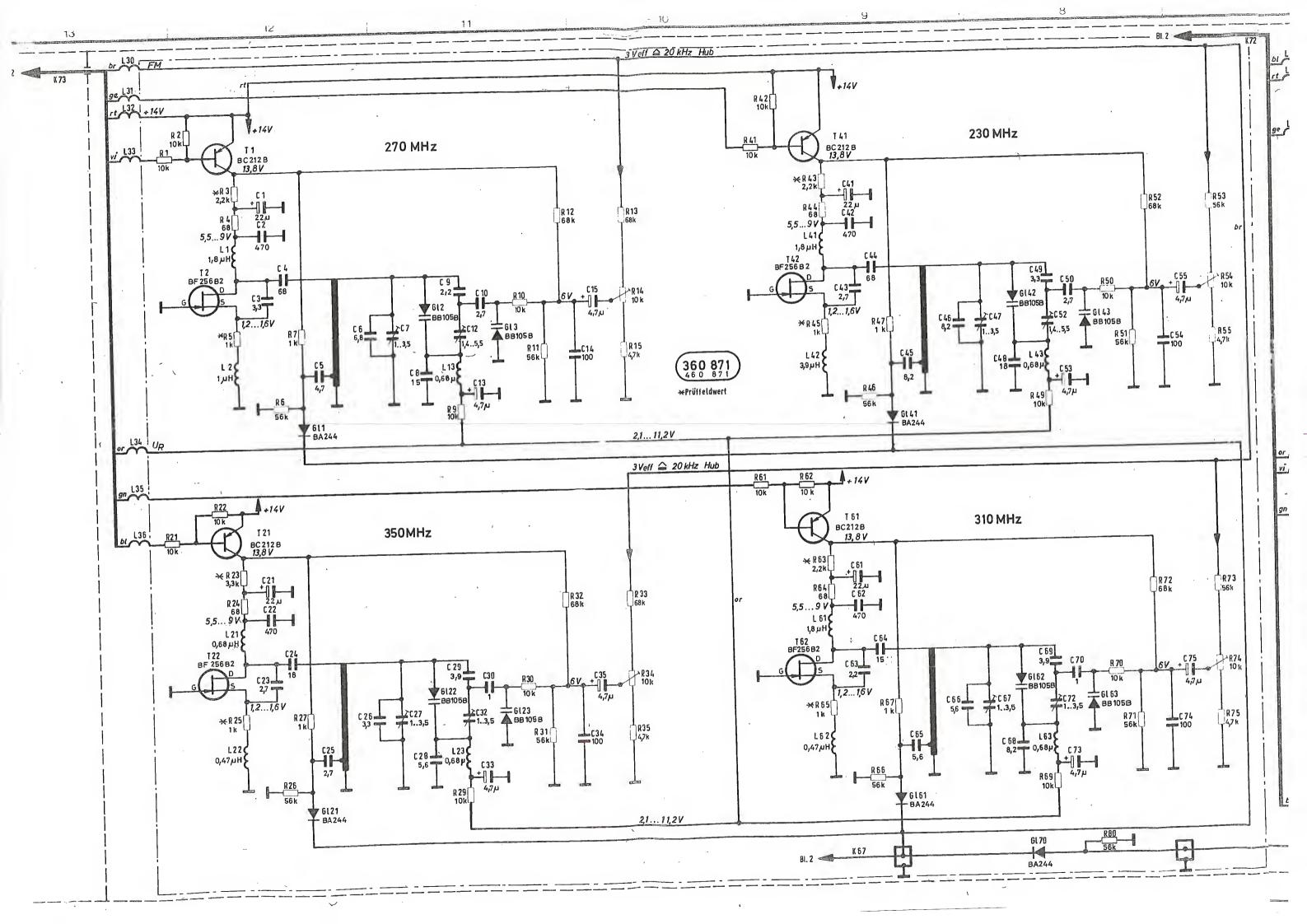
|               | MEASURED       |  | TO 1 THE CONTRACTOR STATE OF THE STATE OF TH |  |                                |           |         |                          |   |   |     |
|---------------|----------------|--|--|--|--------------------------------|-----------|---------|--------------------------|---|---|-----|
|               | REQUIRED VALUE | > 2,2 VDC<br>> 2,2 "<br>> 2,2 "                                | > 2,2 VDC  |  |                                |           |         |                          |   |   |     |
|               | ADJUST         |  | • • 1  | C 52 / R 54<br>C 52 / R 54   | C 12 / R 14                    |           |         |                          |   |   |     |
|               | FREQUENCY      | 200 MHz<br>220<br>240  | 400 MHz  | 200219,999MHz<br>220239,999  | 400419,999MHz                  |           |         |                          |   |   | ·   |
|               | MEASURE        | 90 872   |  | RF-out   |                                |           |         |                          |   |   |     |
|               | PROCEDURE      | Check AFC-potential at other ends of the frequency sub ranges. | 5. FM-Sensitivity adjustment (360870, 71, 72)  | Adjust C 52 in order to get the same deviation at both ends of the frequency sub ranges. Adjust R 54 to get 20 kHz FM deviation. | FM deviation trimmer capacitor | Treus coo | too big |                          |   |   |     |
| REQUIRED TEST | EQUIPMENT      |  | - 1  | 4000, 4901<br>or other<br>Modulation Meter   |                                |           |         |                          |   |   |     |
|               |                | Adjustmen  |  | Test P   | rocedure                       | Name      |         | 4022 (4011<br>Oscillator | ) |   |     |
|               | Schlur         | mberger  | 01   | 502810   | 5.10.73<br>26 2 76             | )(am)     |         | 213 014                  | A | Ś | 2/3 |

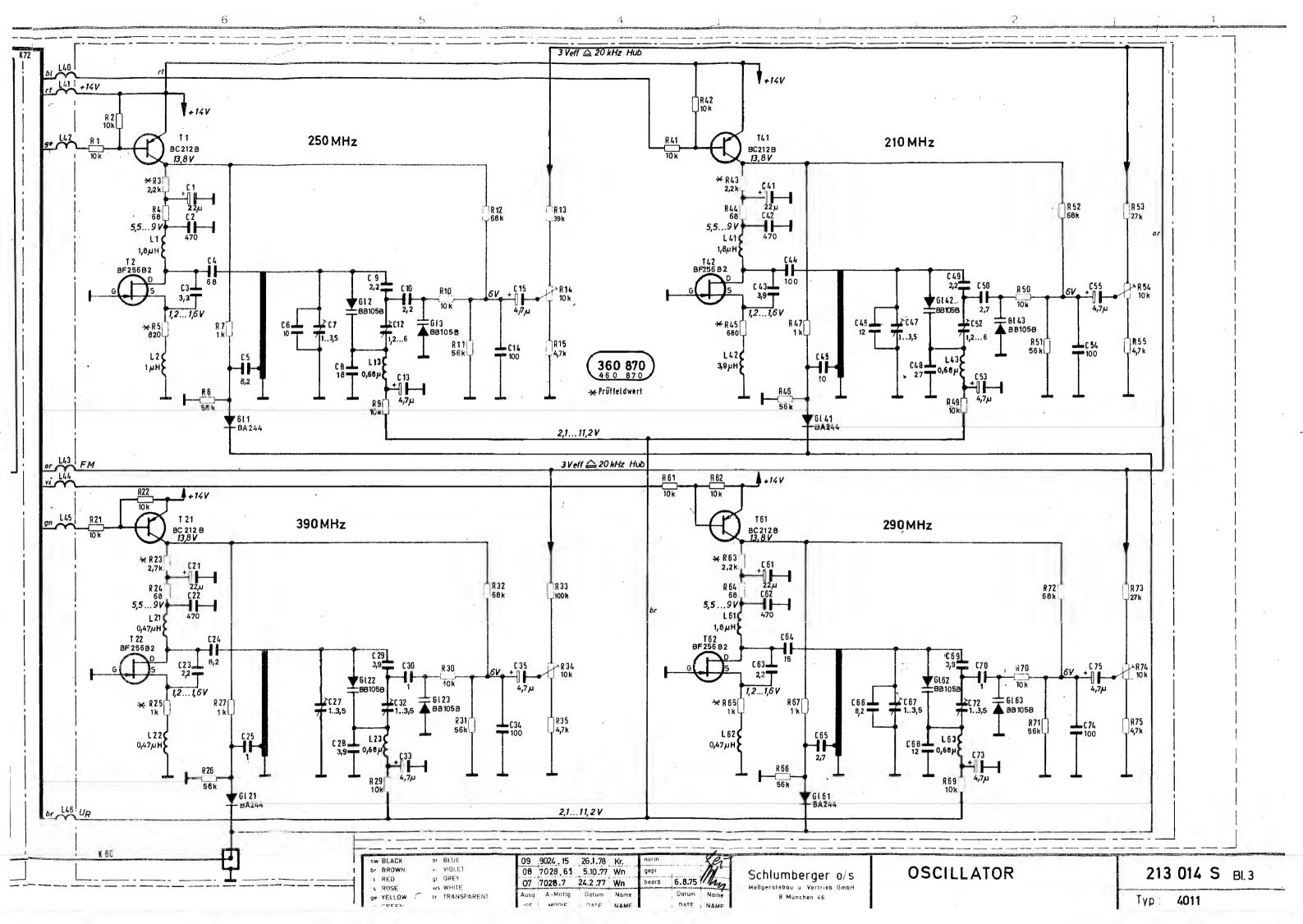
|              | -                         |                         |   |         |                     |        |                    |          |
|--------------|---------------------------|-------------------------|---|---------|---------------------|--------|--------------------|----------|
| Schl         |                           | REQUIRED TEST EQUIPMENT | PROCEDURE   | MEASURE | FREQUENCY           | ADJUST | REQUIRED VALUE     | MEASURED |
| umbe         | Adju                      |                         | 6. Modulation Distortion  |         |                     |        |                    |          |
| rger         | stme                      | 4000, 4901<br>or other  | f mod = 1 kHz<br>FM-Deviation 20 kHz                            | -R      | 200 to<br>419,9 MHz | •      | Dist. < 1%         |          |
| 01           | nt ar                     | and<br>Distortion       |   |         |                     |        |                    |          |
| 502810       | d Test P                  | Analyser                | 7. Unvanted Noise Deviation Phase deviation Frequency deviation | ** **   |                     | • •    | < 8m Rad<br>< 7 Hz |          |
| 5 10,7       | rocedui                   |                         | 8. Modulation Frequency Response                                | **      | # Post              | •      | +1<br>>            |          |
| 3 Uwn        | 'e<br>Name                |                         |   |         | 300 Hz to 10<br>kHz |        |                    |          |
| 1. Sealor em |                           | RF-Analyser             | 9. RF-Harmonics   | -       | 200 to<br>419,9 MHz | 6      | < 34 d8 c          |          |
| 213 014 A    | 4022 (4011)<br>Oscillator |                         |   |         |                     |        |                    |          |
|              |                           |                         |   |         |                     |        |                    |          |
| 3/3          |                           |                         |   |         |                     |        |                    |          |

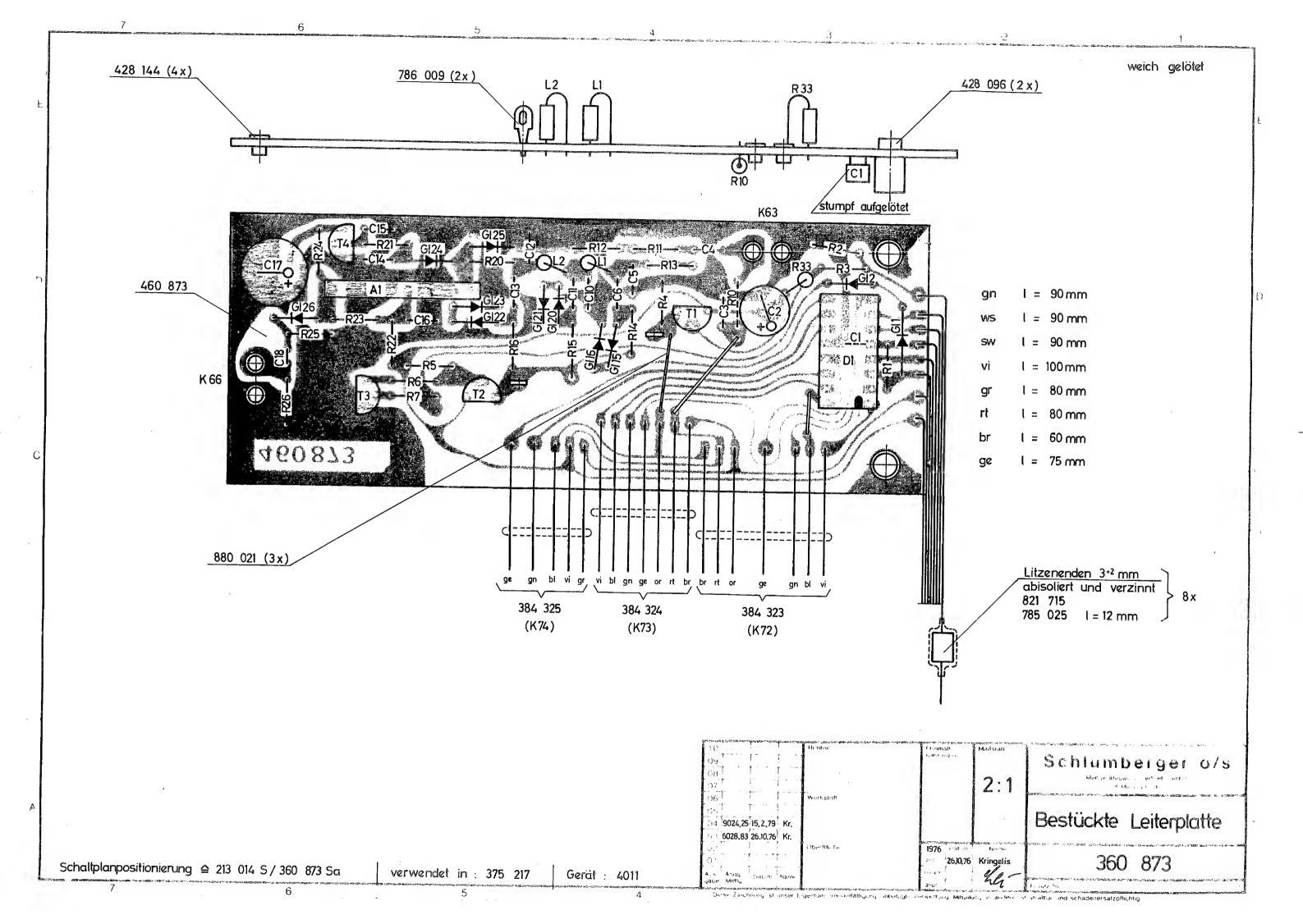


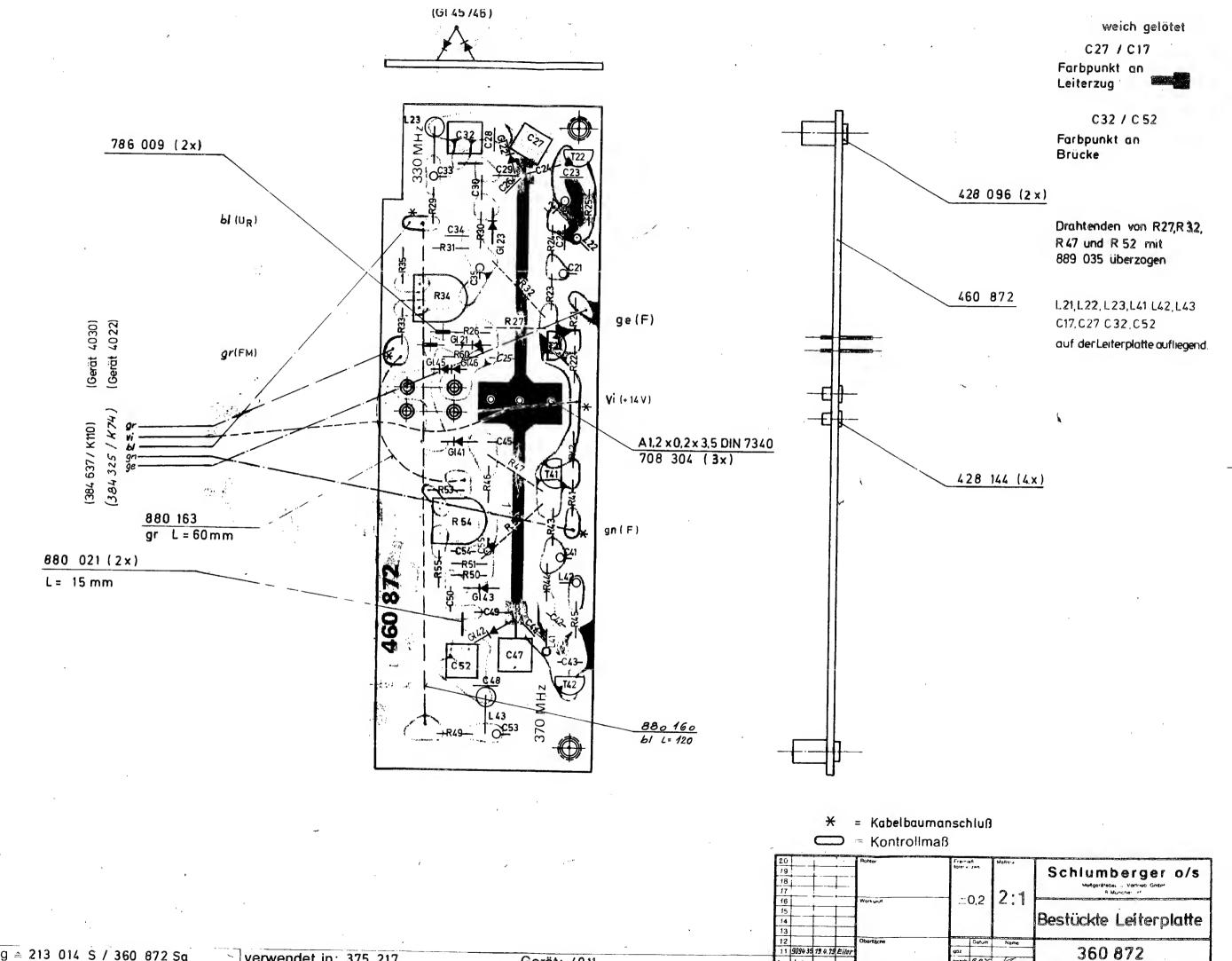
| SW BLACK bi BLUE br BROWN vi VIOLET rt RED gr GREY rs RDSE ws WHITE | 02 6028.20<br>04 9028<br>03 6028.80 | 63 12.9.      | 19 64        | narm.<br>gepr<br>bearb. | 10,11.75 Kr.            | Schlumberger o/s | OSCILLATOR | 213 014 S BL1 |
|---|-------------------------------------|---------------|--------------|-------------------------|-------------------------|------------------|------------|---------------|
| ge YELLOW tr TRANSPARENT<br>gn GREEN                                | Ausg. AMittle<br>ISS. MODIF         | Datum<br>DATE | Name<br>NAME | 1975                    | Datum Name<br>DATE NAME | 8 München 46     |            | Тур : 4011    |











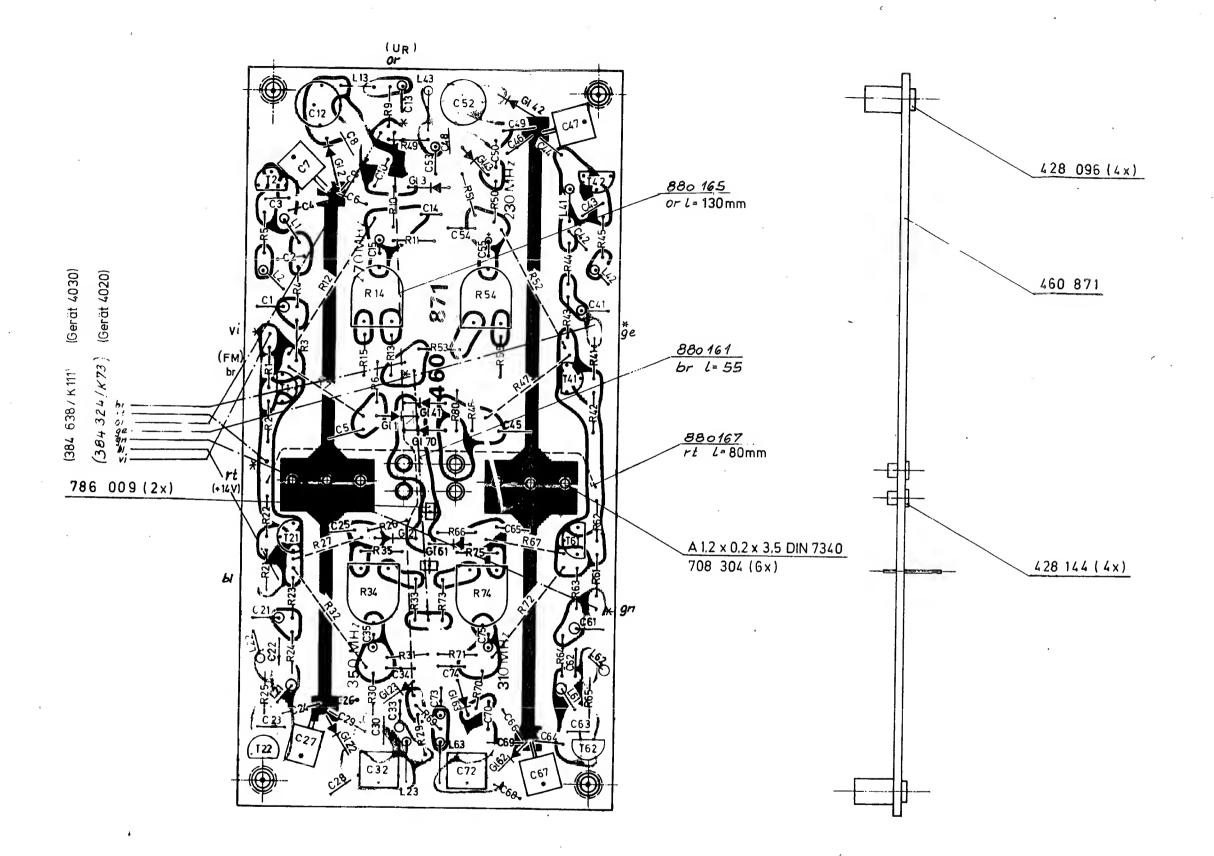
C7 / C27 / C47 / C67

Farbpunkt an Leiterzug

C32 / C72 Farbpunkt an C30 bzw. C70

Drahtenden von R7, R12, R27, R32, R47, R52, R67 und R72 mit 889 035 überzogen

L1, L2, L13, L21, L22, L23 L41, L42, L43, L61, L62, L63 C7, C27, C32, C47, C67, C72 auf der Leiterplatte aufliegend.



🛨 = Kabelbaumanschluß

Kantr maß

| 09<br>08<br>07 | 9028.34 4 5.79 Eiler<br>9094.14 19.2.79 Kr.<br>8028.79 13 10 70 Eiler<br>8028.63 6.6.78 Eiler |     | +0.2                          | 2.1             | Schlumberger o/s        |
|----------------|---|-----|-------------------------------|-----------------|-------------------------|
| 05<br>04       | 602888 29.10 1 844<br>602888 5.336678<br>6028.7 30.1.76 Kc<br>6028.4 14.13648                 | . 1 | ±0,2                          | · ,             | Bestuckte, Leiterplatte |
| 04             | 5028 105 24 1175 Eiler<br>5028 100 27-10-75   | 7.3 | 1975<br>20.8.<br><i>8.9</i> . | Eiler<br>13. Vo | 360 871                 |

C7/C27/C47/C67

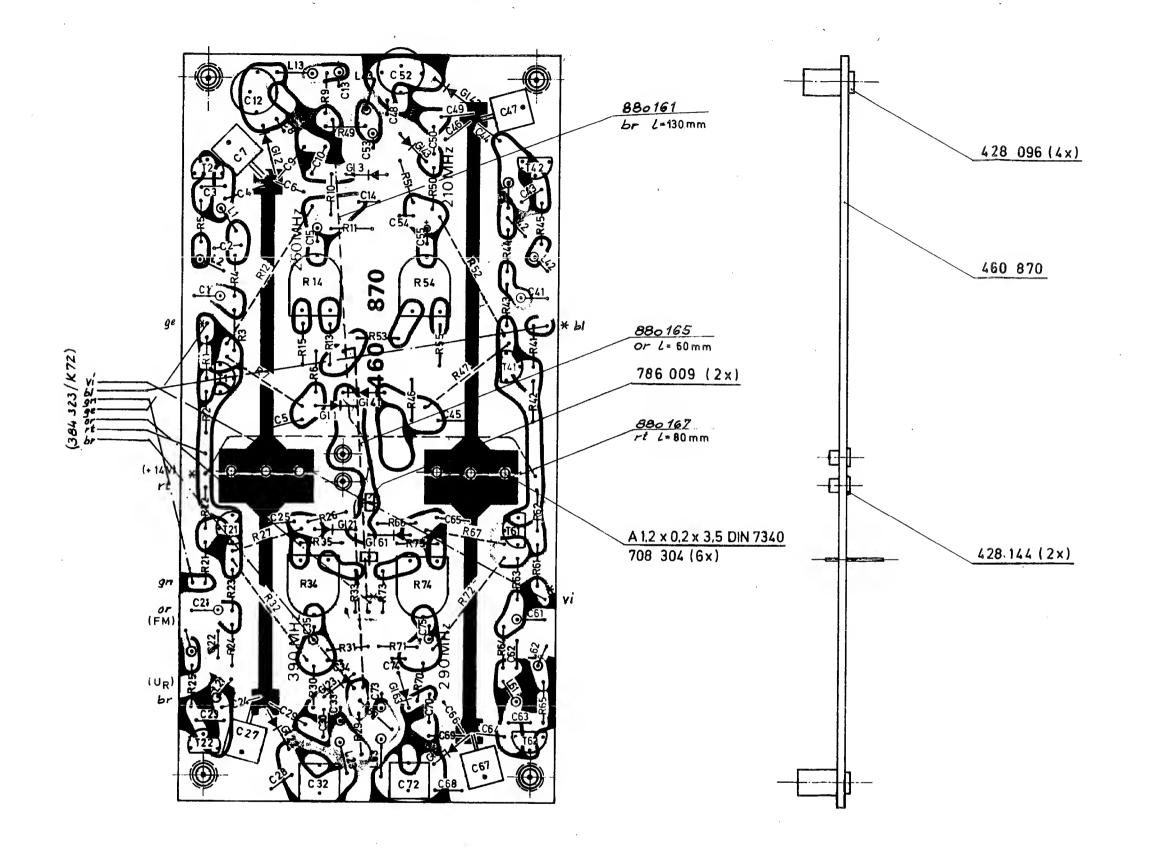
Farbpunkt an Leiterzug



C 32 / C72 Farbpunkt an Brücke

Drahtenden von R7, R12, R27, R32, R47, R52, R67 und R72 mit 889 035 überzogen

L1/L2/L13/L21/L22/L23 L41/L42/L43/L61/L62/L63 C7/C27/C32/C47/C67/C72 auf der Leiterplatte aufliegend.



### Ӿ = Kabelbaumanschluß

→ Kontrollmaß

|                   |      |                               | ,             | 1                       |
|-------------------|------|-------------------------------|---------------|-------------------------|
| 60284 14.1.76     | 16.1 |                               |               | Bestückte, Leiterplatte |
| 5028 109 24 11 75 |      | 1975 20 8<br>- 20 8<br>- 8.9, | Eiler<br>Va V | 360 870                 |

(See block circuit diagram 102 820 B for total instrument)

## 1. 0.1 kHz/1kHz decade (final stage)

The oscillator frequency is crystal stabilized by means of a variable frequency divider and a phase bridge. The BCD requency adjustment of the 100 Hz and 1kHz decade results in the dividing ratio of 4000... 4099, thus permitting digital adjustment of the oscillator frequency between 12.5 and 12.8125 MHz increments of 100 x 3.125 kHz.

#### 2. Vernier offset

The control line " $\Delta f \operatorname{Rec}(D\tilde{C})$ " permits the choice of three functions:

- a) Provision of the final decade frequency with and without division and without offset
- b) Establishing the frequency offset with respect to 2 MHz IF. The IF of approx. 2 MHz provided by the output stage is compared to a 2 MHz signal having crystal accuracy in a mixer and frequency discriminator, the former providing the absolute offset frequency in the form of " $\Delta$  f(AC)" to the counter. The digital frequency discriminator generates TTL pulses on one of the two " $\pm$   $\Delta$ f (AC) lines depending on whether the offset is positive or negative for the  $\pm$  display of the counter
- c) Generating a frequency with continuously adjustable offset to final decade frequency.

The 1/5 devided oscillator frequency is provided to the mixer and frequency discriminator. The reference frequency of approx.

2 MHz at the other mixer input is derived through the frequency devider and multiplier from the final decade. The mixer and discriminator output signals are used for counter displays (same as on IF comparison). These output signals are simultaneously converted into a DC voltage which is a measure for the frequency offset.

This DC voltage is stabilized by the automatic frequency control loop to a set point value which is provided through " $\Delta f(DC)$ " from the potentiometer control.

The 1/8 devided oscillator frequency is then routed to the intermediate decade instead of the final decade frequency.

|              | Function Description | 210 021 F    | Sheet 1/3 |
|--------------|----------------------|--------------|-----------|
| Schlumberger | Type: 4020/21/22     | Decade Stage | Date0979  |

## 3. 10 kHz/100 kHz decade (intermediate decade)

The APC loop operates as for the final decade, the 1/100 divided final decade frequency - with or without offset - being included in an additional mixer in the APC loop of the intermediate decade.

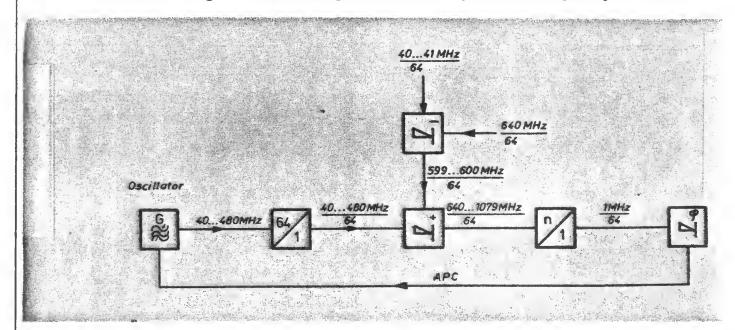
This arrangement permits digital adjustment of the oscillator frequency between 12.5 and 12.8125 MHz in increments of 10 000 (with a vernier offset of + approx. 100 increments).

## 4. 1/10/100 MHz decade (main control loop)

The RF signal provided by the oscillator stage is devided 1/32 down stream of the limiting amplifier. This is followed by three 1/2 frequency dividers in parallel each with an output low pass filter. Depending on the frequency range only one branch is operative to obtain a signal free of harmonics for the subsequent mixer.

Independent of the above arrangement a 1/50 frequency divider provides the 40...480 signal for counter frequency readout.

The following simplified block circuit diagram is meant to simplify understanding the mixed frequencies and adjustable frequency divider:



|              | Functio | n Description | 210 021 F    | Sheet 2/3 |
|--------------|---------|---------------|--------------|-----------|
| Schlumberger | Type:   | 4020/21/22    | Decade Stage | Date 0979 |

The output of the intermediate decade is included in the main control loop by two mixers, each of which is followed by band pass filters to suppress unwanted mixer products. The division ratio of the subsequent frequency divider is dictated by the slightly modified digital frequency adjustment of the 1-, 10- and 100 MHz decade. Indipendent of this the division ratio is increased by 2 (automatic IF offset) on transmitter measurements using the control line "TR Rec (DC)".

The output frequency of the divider is roughly controlled by a frequency control and with crystal accuracy using a phase control: if operation is still non sync the beat frequency at the output of the digital frequency discriminator (see frequency discriminator in vernier offset stage) provides control of a counter to cause the counter to count up or down depending on whether the frequency offset is positive or negative. The DC voltage change is accordingly subsequent to the digital analogue converter and controls the RF oscillator frequency to minimum frequency offset through the APC loop until the phase bridge operating in parallel is able to take over the remainder of the control.

|              | Function  | Description | 210 021 F    | Sheet 3/3 |
|--------------|-----------|-------------|--------------|-----------|
| Schlumberger | Type: 402 | 0/21/22     | Decade Stage | Date 0979 |

| MEASURED                   |  |                                  | V                      | All                        |                                    |                           | do  |      |                                      | ٨                              | yo           |                      | 40                           | डा                                | , de                  |   |               |
|----------------------------|--|----------------------------------|------------------------|----------------------------|------------------------------------|---------------------------|---|------|--------------------------------------|--------------------------------|--------------|----------------------|------------------------------|-----------------------------------|-----------------------|---|---------------|
| REQUIRED VALUE             |  |                                  | 4,95 5,05 V<br>0,8 1 A | 13,95 14,05 V<br>90 110 mA |                                    |                           | 250 kHz<br>3 125 kHz  |      |                                      | Digitalvoltmeter + 5,7 + 6,6 V | 2,5 M1z      |                      | 12 14 V                      | Puls width at + 6 V<br>0.2 0.3 us | +3 +4 V. JOL          | 2,5 Mz  | v 0,50 v      |
| ADJUST                     |  |                                  |                        |                            |                                    |                           |   |      |                                      |                                | 1 12         |                      |                              |                                   |                       |   | (·L 12)       |
| FREQUENCY                  |  |                                  |                        |                            |                                    |                           | 250 kHz   |      |                                      | 1                              | 2,5 MHz      |                      | 3,125 MHz                    |                                   | •                     | 2,5 MHz   |               |
| MEASURE                    |  |                                  | <b>⋄</b>               |                            |                                    |                           | 8 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4   | >    | (                                    | Ð                              | <b>85 25</b> |                      | (S)                          |                                   | 9                     | \$ | <u>6</u>      |
| PROCEDURE                  | The Decade Stage can be pre-checked as an independent unit up to 95 %. | Supply Voltages 210 027 S Bl. 18 | connect + 5 V to St 23 | m + 14 V to St 23          | Frequency Divider 210 021 S 81, 3: | apply 10 MHz TTL to 8u 42 | (Frequency measurements up to approx. 30 MHz can be carried out, by using the probe of an oscilloscope in |      | CITIEST DECAUS STAYE CIO OCI S DIS C | apply + 0,60 V to(7)           |              | Sample-Hold-Detector | disconnect 10 MHz from 8u 42 | connect + 0,60 V to               | apply 10 MHz to Bu 42 | Disconnect the Power Supply from (7)                        |               |
| REQUIRED TEST<br>EQUIPMENT |  | Power Supplies                   | 7 0,2                  | Dig. Voltmeter             | 10 MHz-Crystal                     | OSCILLATOR WITH           | Counter   |      | O 3 V                                |                                |              | Oscilloscope         |                              |                                   |                       |   |               |
|                            | Adjust   | mer                              | 1                      |                            |                                    | _                         | edure   |      |                                      |                                | 4020 (4      | 4010) :<br>E STAG    | series<br>E                  | 5                                 |                       |   |               |
| Sch                        | lumberge   |                                  | Issue<br>OA            | Alterat                    | ion No.                            |                           | .1.78<br>C 24   | Name | . 1                                  | Past                           |              | 210 02               | 1 A                          |                                   |                       |   | 1/11<br>Sheet |

|   | MEASURED<br>VALUE          | , v   |  |
|---|----------------------------|---|--|
|   | REQUIRED VALUE             | + 0,80 0,90 V<br>+ 1,00 1,40 V<br>+ 1,20 1,40 V<br>+ 1,25 1,45 V  |  |
| • | ADJUST                     |   |  |
|   | FREQUENCY                  | 2,50<br>2,54<br>2,54<br>2,56<br>2,56<br>2,500625<br>1250<br>1875<br>2500<br>3125  | 3750<br>4375<br>5000<br>5625<br>1250<br>1875<br>2500<br>3125<br>3750<br>5000<br>5625 |
|   | MEASURE                    | © .   |  |
|   | PROCEDURE                  | Final Decade Stage - Frequency Control 210 021 S  81.7 and 81. 1:  0ecade switch connected to St 22  (or to 8u 5/81.1)  Frequency setting 000 0000  32  64  96  99  7 step = 625 Hz  On  02  03  04  05   | ,<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00      |
|   | REQUIRED TEST<br>EQUIPMENT | Oecade switch, wired as shown on 209 001 S B1.7 (S 10/Bu 22) - Replacement for Frequency Centrol switch on front panel when the Oecade Stage is adjusted with- out use of the Centrol and Dis- play Unit. |  |
|   |                            | Adjustment and Test Procedure   | 4020 (4010) series   |
|   |                            | Issue Alteration No. Date Name  | DECADE STAGE   |
|   |                            |   | 210 021 A 2/11<br>Sheet  |
|   | Sch                        | 12.5.75 Sh  | 104 Replacement for  |

| MEASURED<br>VALUE          | A  | A  | dd Ae   | dBm                                       | dBm   | ok<br>d8m                  | yook                                    | 8p                       |   |
|----------------------------|--|--|---|---|---|----------------------------|---|--------------------------|---|
| REQUIRED VALUE             | Digital-Voltmeter + 5,7 + 6,6 V  |  | 60 100 nV PP<br>pp<br>1,2125 Miz                      |   | - 46 50 dBm                                 | t                          | than upper mixt.product  1,7 2,8 V (FM) |                          |   |
| ADJUST                     | 1 12   |  | BC level on (7)                                       | at 12,125 MHz  DC level on (7)  R 4 P min | at 12,5 MHz (appr. middle)                  |                            | in.e                                    |                          |   |
| FREQUENCY                  | 1,25 Miz   | 12,5 MAz   | 125 kHz<br>1,2125 MHz                                 | 1,25 Mrz<br>12,5 Mrz                      | 12,375 MHz                                  | 12,80 MHz                  | 12,80 MHz                               | 12,3 12,8 Wiz            |   |
| MEASURE                    |  | 0  |   |   | Bu 1  | Bu 1                       | 4                                       | <b>(4)</b>               |   |
| PROCEDURE                  | Intermediate Decade - Oscillator 210 021 S Bl. 5 and Bl.1: + 0,60 V on (7) | Mixer  Decade switch to St 22  Frequency setting: 000 0000 | R 4 fully anti-clockwise and - 0,2 V connected to (7) | approx. + 0,60 V on (7)                   | (Mixture product 12,5 - 0,125 - 12,375 MHz) | approx. + 1,6 V on (7)     | Oscilloscope with probe to 4 er         | Analyser with probe to 4 |   |
| REQUIRED TEST<br>EQUIPMENT | Power Supply 0 3 V Dig. Voltmeter  | Decade switch<br>Oscilloscope                              |   |   |   |                            |   |                          |   |
|                            | Adjustmer  |  | est Pro   | ocedure                                   | Name  | 4020 (4<br><b>DECADE</b> S | 010) serie<br>TAGE                      | s                        |   |
| Schi                       | umberger   | Issue Alterat  |   |   | Shuh  | 21<br>Replacement          | 0 021 A                                 |                          | s |

| ∗Sc           |                            | REQUIRED TEST<br>EQUIPMENT |                   | PROCEDURE  | MEASURE | FREQUENCY                            | ADJUST | REQUIRED VALUE                          | MEASURED |
|---------------|----------------------------|----------------------------|-------------------|--|---------|--------------------------------------|--------|---|----------|
| hlumbe        | Adju                       |                            | Sample - Hold     | - Detector 210 021 S B1, 5:  |         |                                      |        |   |          |
| erger         | ıstme                      |                            |                   | Remove 10 MHz from Bu $45$   | ©       | 3,125 kHz                            |        | 12 14 V                                 | 90       |
| 01            | issue                      |                            |                   | )  | )       |                                      |        | Puls width at + 6 V<br>0,2 0,3 µs       | 3        |
| 8028.9        | Alteration                 |                            |                   | 10 MHz to Bu 42<br>+ 5 V on (26) ("NO OFFSET" Command)<br>Disconnect Power Supply from (7) | 90      |                                      | (1 12) | *3 *4 V * O * O * O * O * O * O * O * O | ¥0       |
| 1.            | _                          |                            | Frequency Control |  | \$      | 1,25 MHz                             |        | 1,25 FHz                                | yo       |
| 3.1.78        | Date Date                  |                            |                   | Connect decade switch to St 22 Setting: 000 0000 3200                                      | 0       | 1,25 MHz<br>1,26                     |        | V 09.0 + 08.0 +                         |          |
| X             | Name                       |                            |                   | 6400<br>9600   |         | 1,27<br>1,28<br>1,28122              |        | : : :                                   | ٦,٧      |
| n Re          | 1                          | T                          | Further setti     | Further settings, needed only for localizing of faults                                     |         |                                      |        |   |          |
| 210 021       |                            |                            | 1 step            | 1 step = 312,5 Nz 0100<br>0200<br>0400<br>0800   |         | 1,2503125<br>06250<br>12500<br>25000 |        |   |          |
| A             | 4020 (4010)<br>DECADE STAC |                            |                   | 1000<br>2000<br>4000<br>8000   |         | 1253125<br>56250<br>62500<br>75000   | सेल    |   |          |
|               | series<br>GE               |                            |                   |  |         |                                      |        |   |          |
| 4/11<br>Sheet |                            |                            |                   |  |         |                                      |        |   |          |

|   | MEASURED<br>VALUE          |  |                    | yo o o  | ŏ                                      |               |   |                       | , ok                          | , ok  |                                | , ok               |               |
|---|----------------------------|--|--------------------|---|--|---------------|---|-----------------------|-------------------------------|---|--------------------------------|--------------------|---------------|
|   | REQUIRED VALUE             | TTL: 0,3125 MHz 0,625  | 10                 | 15,25 16,25 MHz   | TTL: 12,5 kHz<br>100 "<br>325 "        |               | 3   |                       | - 30 40 dB                    | 40 60 Урр                                     | Harmonics > 20 dBc             | Harmonics > 10 dBe |               |
| , | ADJUST                     | Ŧ  |                    |   |  |               |   | L 13 min. Level       | at 9,375 MHz<br>(3. Harmonic) |   |                                |                    |               |
|   | FREQUENCY                  |  |                    | 15 500 MHz  |  |               |   |                       |                               | 3,1258,125MHz<br>1,6253,125 W<br>0,6251,625 W | 3,1258,125MHz<br>1,6253,125 "  | ,62                |               |
|   | MEASURE                    | Output vi  |                    |   | Bu 20                                  |               | Analyser<br>50 o =                            | in shunt<br>with K 33 |                               | Oscillo-<br>scope to<br>K 33                  | Analyser<br>50 a -<br>in shunt | with K 33          |               |
|   |                            | 81. 2s<br>d8m on 8u 40 s 10 MHz<br>20 MHz<br>32 MHz<br>160 MHz | 320 MHz<br>400 MHz | 480 MHz<br>520 MHz<br>) from 10 to 520 MHz<br>) from 15 to 500 MHz<br>ps)                                       | on Bu 40; 20 MHz<br>160 MHz<br>520 MHz |               | Checking control lines                        | <b>€</b> \$ •6        | 0                             | 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0       | 0 0 0                          |                    |               |
|   | PROCEDURE                  | 210 021 S<br>approx. 0   |                    | Same procedure at +10 dBm on Bu 40 from 10 to =10 dBm on Bu 40 from 15 to (from 400 to 500 MHz in 10 MHz-steps) | approx. O d8m on 8u 40:                |               |   | setting gr 🖘          | 200 MHz                       | 200<br>100<br>40                              | 200<br>100<br>60               |                    |               |
|   |                            | RF / 32 - Divider  |                    | Same procedure a  | f/50 - Divider                         | f/2 - Divider | Input frequency Decade                        | 8u 40                 | 200 MHz                       | 200520<br>100200<br>40100                     | 200520<br>100200<br>64100      | 4064               |               |
|   | REQUIRED TEST<br>EQUIPMENT | Synthesizer 20520MHz Counter 020 MHz                           |                    |   |  |               | Decade switch<br>Spectrum Analyser<br>010 MHz |                       |                               | Oscilloscope                                  |                                |                    |               |
|   | _                          | Adjustmer  |                    |   | _                                      |               |   |                       | 4020<br>DE0                   | (4010) seri<br>CADE STAGE                     | ies                            |                    |               |
|   | Schl                       | umberger   | lssue OA           | Alteration No.  | 13, 1.7.                               | 8             | X   | Replace               |                               | 021 A   |                                |                    | 5/11<br>Sheet |

| Sch           |                         | REQUIRED TEST<br>EQUIPMENT   | PROCEDURE   | MEASURE       | FREQUENCY                                       | ADJUST  | REQUIRED VALUE                           | MEASURED          |
|---------------|-------------------------|--|---|---------------|---|---|--|-------------------|
| lumberg       | Aujus                   | Adius  | MHz - Decmdes, Mixer O 7 210 021 S 81. 3:                 |               |   |   |  |                   |
| <b>j</b> er   |                         | Decade switch  | . Frequ. Setting 000 0000                                 | <u></u>       | 10 MHz  |   | 40 60 aVpp                               |                   |
| 01            | Issue                   |  | Analyser via probe  | 9 9           | 625 kHz<br>9,375 MHz                            | R 11middle pos.   | 80 120 «Урр                              | yo                |
| 3628.9        | Atteration No.          | og de state of the | Analyser via probe.                                       | © =           | " " " 9,375/10 MHz                              | at 9,375 MHz L 4— max. level R 11— min. level                             |  | ok                |
| 13            | _                       | Proc   | Oscilloscope via probe                                    | <b>⊙</b>      | 9,375 MHz                                       | שנו וח שוול   | 150 250 mVpp                             | qq <sup>V</sup> m |
| .1.78         | ate                     | · edu  |   | ©             |   |   | 50 100 mVpp                              | dd <sub>A</sub>   |
| X<br>Shul     | Name                    |  | Mixer D 10  |               |   |   |  |                   |
| n Rep         |                         | Synthesizer  | Analyser via probe on ——————————————————————————————————— |               |   |   |  |                   |
| lacement      |                         |  | approx. O dBm on Bu 40   Decade switch                    |               |   |   |  |                   |
| 210 021 A     | 4020 (4010<br>DECADE ST |  | 0 MHz 0 0 144 40 1144 40 1144 40 1144 1144 1              | <b>©= = =</b> | 9,375 MHz<br>8,75 MHz<br>7,125 MHz<br>16,85 MHz | R 15— min. level<br>L 6— min. level<br>L 5— min. level<br>L 7— max. level | ca. = 70 dBc  ca. = 30 dBc  ca. = 30 dBc |                   |
|               | ) series<br>AGE         |  | 40 60 MHz<br>by L 4)                                      |               | 1010,3 MHz                                      |   | > 20 dBc                                 | >d8               |
| 5/11<br>Sheet | 1                       |  | 40480 MHz 40480 0 MHz                                     | = =           | 1016,85 MHz<br>9,375                            | R 15  | 1,5 2,5 Vpp < 0,1 Vpp                    | γου               |

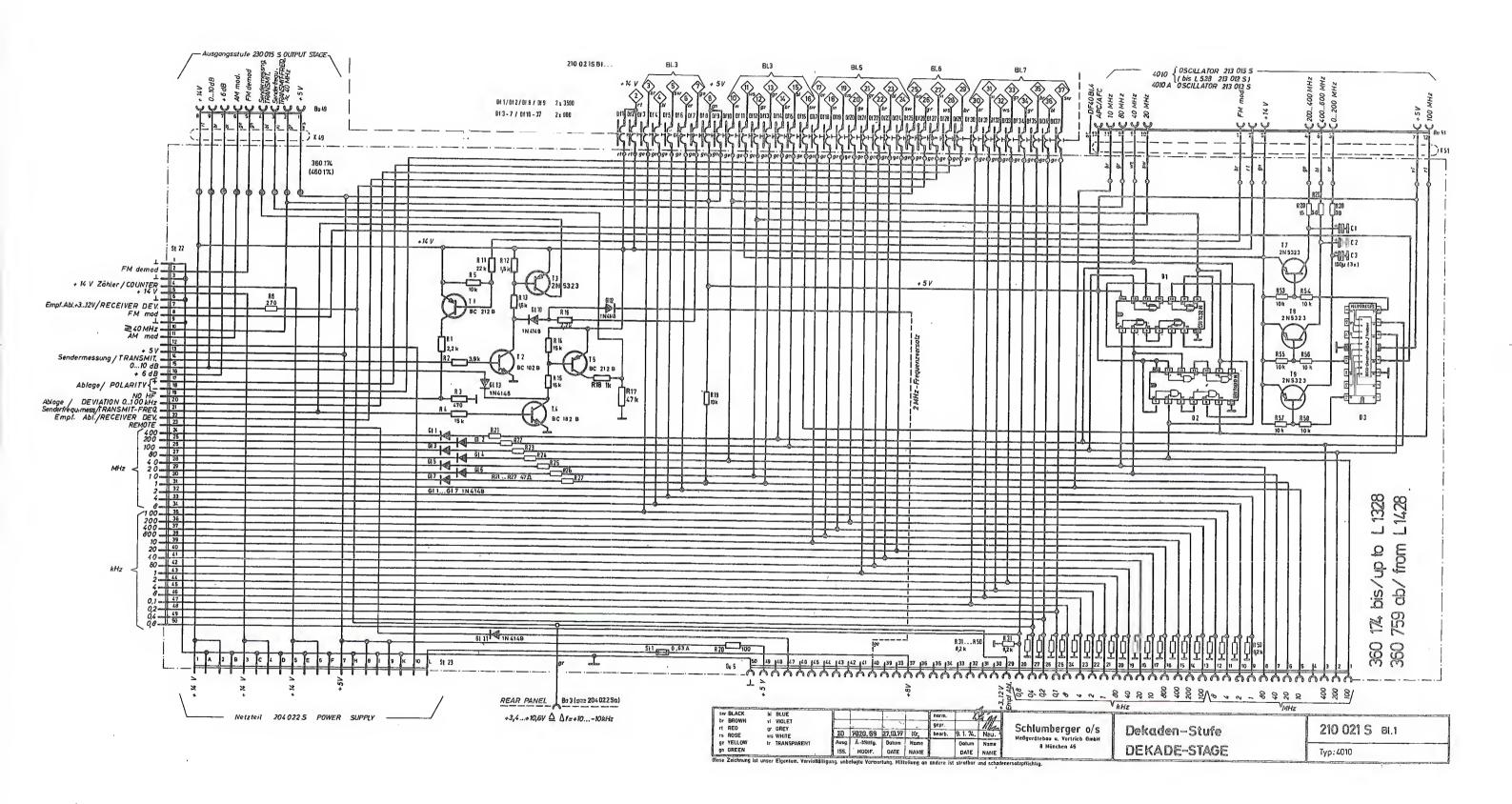
| REQUIRED TEST  Synthesizer  Synthesizer  Synthesizer  Synthesizer  (When the between p between p Change se Stepwise se Stepwis | PROCEDURE Frantiancy Hydger and Frantiancy Companions 210 024 81 3.   | Ш       | 7070                       | 10. II O 4 | Jillay Obdii loba                    |                   |
|--|---|---------|----------------------------|------------|--------------------------------------|-------------------|
| Synthesizer  |   | POINT   | FREUDENCY                  | ADJUSI     | אבתחועבת אשותב                       | MEASURED<br>VALUE |
| Synthesizer  |   |         |                            |            |                                      |                   |
|  | 520 MHz approx. 0 dBm on Bu 40<br>Frequency setting 520 0000  | \$0     | 15,625 kHz                 |            | Puls width<br>210 270 ns<br>13 19 µs | sh                |
|  | (When the OSCILLATOR sub unit is not used, connect 10 km between pin 6 of Bu 5 and 45 V rail)               |         |                            |            |                                      |                   |
|  | Decade switch setting 520 40 MHz (disconnected yellow lead (57)) Change setting stepwise to smaller values. | 0       | 15,625 kHz<br>to<br>27,344 |            | 15,625 27,344                        | ŏ                 |
| ıre  | Stepwise increasing of autput frequency must result.  Oscilloscope simultaneously (altern.) on (57) (58)    |         |                            |            |                                      |                   |
|  | Frequ. setting 400 0000<br>400 MHz, 0 dBm on Bu 40  | ***     |                            |            | TTL = Output<br>L or O (L-appr. 4 V) |                   |
|  |   | & br    |                            |            | (0-appr. 0 V)                        |                   |
|  | 464 MHz, 0 dBm on Bu 40   | 96 (\$) |                            |            | 7                                    |                   |
|  |   | Sp br   | 1,000 kHz                  |            | 1 kHz                                | ok                |
| 400  | 336 MHz, 0 dBm on Bu 40   | ***     | 1,000 kHz                  |            | 1 kHz                                |                   |
| 20 (4 <b>Q</b><br>ECADE  |   | Sp br   |                            |            | ١                                    |                   |
| 110) seri  | 400 MHz, 0 dBm on Bu 40<br>Decade setting 410 419 MHz   | e6 €\$  |                            | Ĭ          | L continuous response                | , ok              |
| es   |   |         |                            |            |                                      |                   |
|  |   |         |                            |            |                                      |                   |

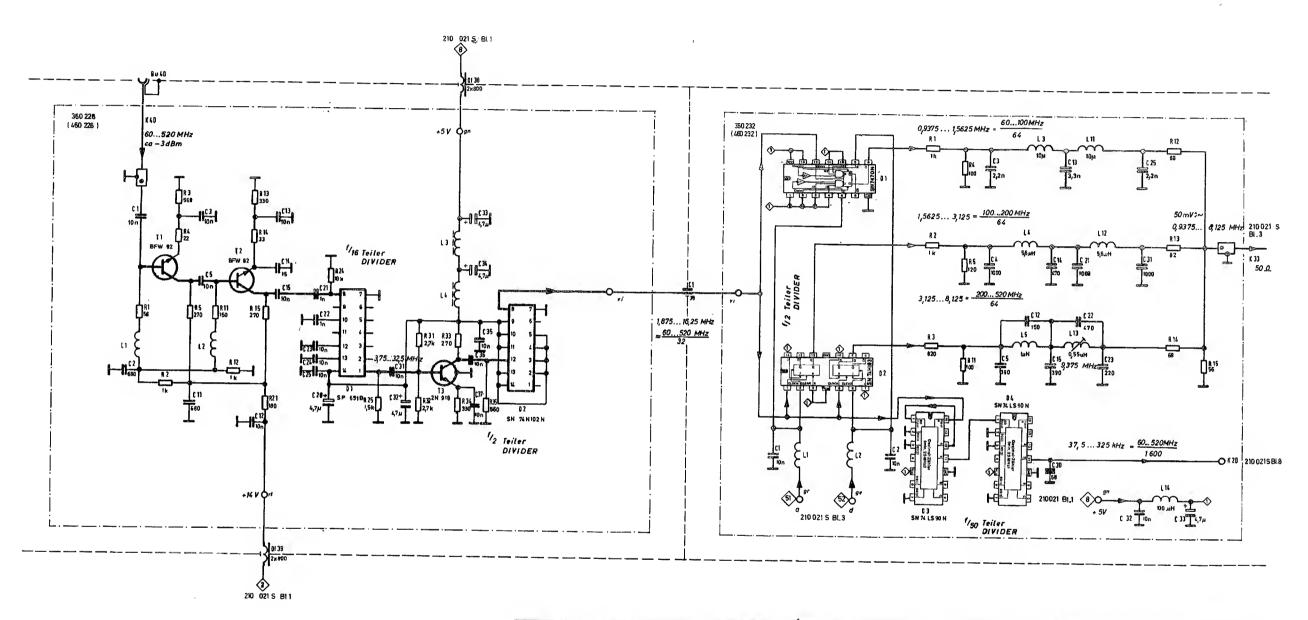
|               | -               |                            |  |                     |             |                  |                |      |  |
|---------------|-----------------|----------------------------|--|---------------------|-------------|------------------|----------------|------|--|
| Schl          |                 | REDUIRED TEST<br>EQUIPMENT | PROCEDURE  | MEASURE             | FREQUENCY   | ADJUST           | REQUIRED VALUE |      | MEASURED<br>VALUE                      |
| umber         | Adjus           |                            | Frequ. Offset/TRANSM. MEASUREMENT 210 021 S 81. 6:     |                     |             |                  |                |      |  |
| ger           | stme            | Counter                    | 10 MHz TTL on 8u 42                                    |                     |             |                  |                |      |  |
| C.A           | Issue           | Oscilloscope               | #NO OFFSET# on REC. MEASUREMENT = 5 V on St 22/22 = 26 | 360 234 0 1/5       | 000         |                  |                |      |  |
| 803           |                 |                            |  | JA -                |             |                  | 2              | ZE   |  |
| 8.9           | est Plation No. | Synthesizer                | 2 MHz TTL on Bu 43                                     | 360 236<br>D 2/6    | 2,000 MHz   |                  | ТТ 2           | MH2. | , ok                                   |
| 13,1          | Date            |                            |  | 360 234             |             |                  |                |      |  |
| .78<br>.20    | _               |                            |  | )                   |             |                  | Puls 120160 ns |      | yo                                     |
| 5             | -               |                            | 2,01 MHz TTL on Bu 43                                  | Sp.                 | 10 kHz      | (L 3 with tuning | TT. 10         | kHz  |  |
| Hol           | ame             |                            |  | SN SE               |             | slug)            | +3,5 5 V       | _    |  |
| Ren           |                 | The second                 |  | 360 234<br>R 3 = vi | 10 kHz      |                  | 1,54,5Vpp      | •    | yo.                                    |
| lacem         |                 |                            | 1,99 MHz ITL on Bu 43                                  | sa<br>®>            |             |                  | +3,5 54        |      |  |
| ent fo        |                 |                            |  | Sp pr               | 10 kHz      |                  |                | kHz  |  |
| 210 (         | 4020<br>DEC     |                            |  | R 3 = vi            | 10 kHz      |                  | 1,54,5Vpp      | •    | 40                                     |
| 021           | (40<br>ADE :    |                            | Frequency Multiplier                                   |                     |             |                  |                |      |  |
| A             | 10) se<br>STAGE |                            | "OFFSET ON" on REC. MEAS St. 22/22 resp. (26)          | \$ at               |             |                  | Λ 0            |      |  |
|               | ries            |                            | Decade switch: 000 0050                                | 8                   | 2,53725 MHz |                  | 2,53125        | MHz. | yo                                     |
|               |                 |                            |  | 0                   | 5,0625 MHz  | L 2 max.level    | 4 8 Vpp        |      |  |
|               |                 |                            |  | <b>3</b>            | 10,125 MHz  | L 3 max.level    | 5,5 7 Vpp      | •    | ,0k                                    |
| 8/11<br>Sheet |                 |                            |  | 0 2/6<br>- 9e       | 2,025 MHz   | 1                | TTL 2,025 P    | MHZ  | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |
|               |                 |                            |  |                     |             |                  |                |      |  |

| Sch          |              |                            | REQUIRED TEST<br>EQUIPMENT                               | PROCEDURE  | MEASURE                                  | FREQUENCY              | ADJUST                        | REQUIRED VALUE                          | MEASURED                                |
|--------------|--------------|----------------------------|--|--|--|------------------------|-------------------------------|---|---|
| lumberg      |              | Adjus                      |  | Oscillator 210 021 S 81. 6:  |  |                        |                               |   |   |
| er           |              | tme                        |  | 45 V on (2)  | 9  | 10,04 MHz              | L 5                           | 10,04 MHz                               |   |
| GA           | Issue        | nt ar                      |  |  | 0 5/6 or                                 | 10,04 MHz<br>1,255 MHz | 1.5                           | approx.10,04 MHz<br>1,255 MHz           | Ą                                       |
| 8028.3       | Afteration I | nd Test                    |  | +3,2 V on (2)<br>+9 V on (2)   | <del>)</del>                             | 8,69,2 #               |                               | 8,6 9,2 MHz                             | , o , o , o , o , o , o , o , o , o , o |
| 12.5.73      | No. Date     | Procedu                    |  |  |  |                        |                               |   |   |
|              | Name         | re                         |  | (26) (grey) to ground<br>(25) (white) disconnected<br>Decade switch: 000 0050  |  |                        |                               |   |   |
| Replacer     | _            |                            |  | +3,2 V on (2)<br>+9 V on (2)   | R 3 = vi                                 | approx, 200 kHz        | L 3-pmax,level<br>symmetrical | 2 3,5 V pp                              | ddy                                     |
| 210 02       |              | 4020<br>DF                 |  | Vernier Offset on RECEIVERMEASUREMENT  |  |                        |                               |   |   |
| 1 A          |              | (4010) serie<br>CADE STAGE | Pover Supply 14 V<br>Potentiometer 10 km<br>Oscilloscope | R 34/ R 24 middle position +2 v on the on the on the on the on the ontil the on the ontil the on the ontil the outer of | \$\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ | 10 14 kHz              |                               | 30                                      |   |
|              |              | es                         | Counter<br>DVM   | decrease DC level on (25) slowly, until f on (27)  |  | 10 14 kHz              |                               | +2,5 +3,3 V<br>High or Low<br>10 14 kHz |   |
| 9/11<br>Shee | 0/44         |                            |  |  | \$3.                                     |                        |                               | v 2,11+ 11+                             | , o , , , , , , , , , , , , , , , , , , |

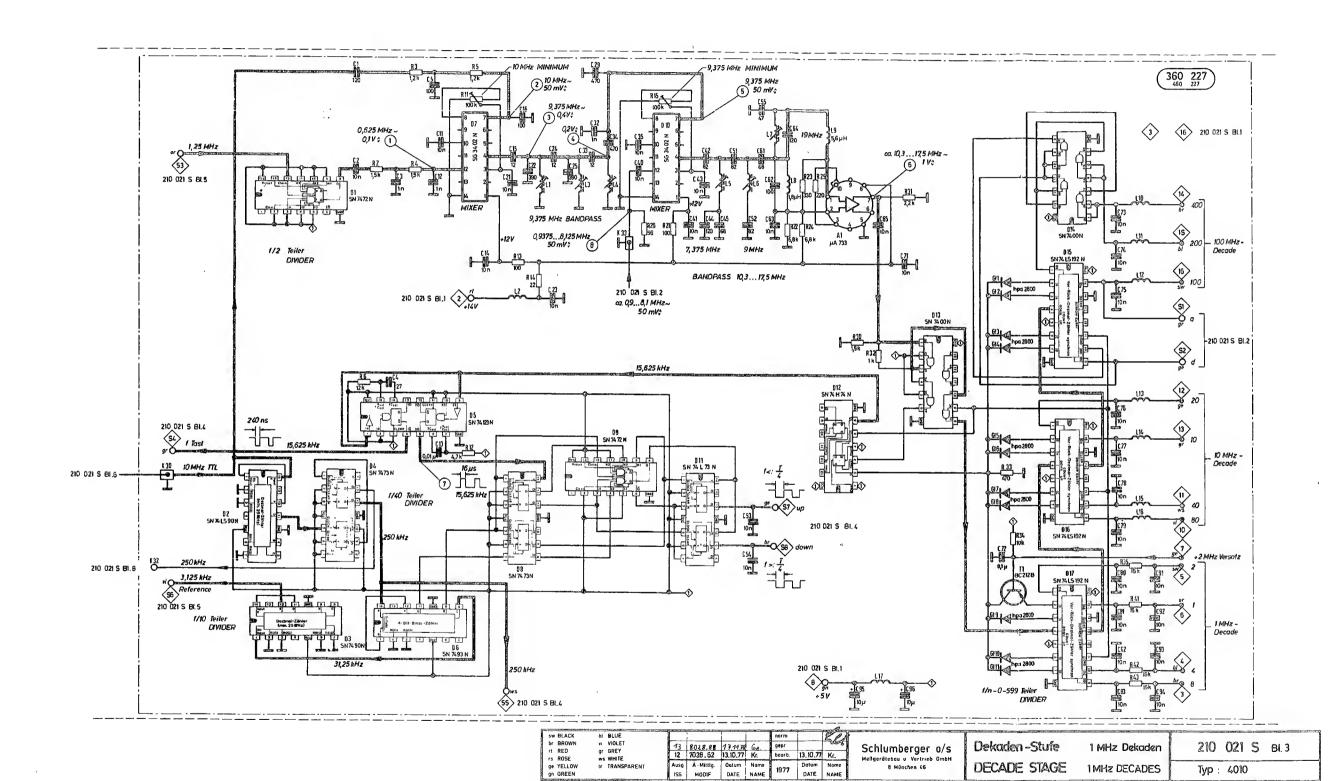
|   | MEASURED<br>VALUE          |  |   |                                      |   |                                |                       | yook                        |              | 90 · · · · · · ok |   |                 | , ok              | 9                  | >   |            | 7  |
|---|----------------------------|--|---|--------------------------------------|---|--------------------------------|-----------------------|-----------------------------|--------------|-------------------|---|-----------------|-------------------|--------------------|---|------------|--|
|   | REQUIRED VALUE             | 0 Hz<br>10 kHz   | 10,5 12,5 kHz<br>\$\infty\$ f < 0,2 kHz |                                      | Δ† < 5 Hz   |                                |                       | 4 3,8 4,8 V                 | 4 3,8 4,8 V  | V 4.0+ 0          | Saw tooth with NNN 256 steps step amplitude | ing:            | V max: +1,4.      | 12                 | Carlo | ti v v min | t <sub>1</sub> = 10 35 ms<br>t <sub>2</sub> = 30 50 ms |
| • | ADJUST                     | R 34<br>R 5  | R 24 equal frequency                    |                                      |   |                                |                       |                             |              |                   |   |                 |                   |                    |   | ,          |  |
|   | FREQUENCY                  | 0 Nz<br>10 kHz   | 10,5 12,5kHz R 24                       | 210 270 Hz                           |   |                                |                       |                             |              |                   | 7,5 Hz                                      | OLYGORY CO.     |                   | •                  |   |            |  |
|   | MEASURE                    | The Colonian | •                                       | •                                    | ~~<br>  |                                |                       | 9                           | <u>-</u>     | <u> </u>          | (b)   |                 |                   | T 11 Coll          |   |            |  |
| _ | RE                         | V on 25 us   |   | 2. and 3.<br>5 V on (25) ws<br>5 V m | limits. se available at rear panel Bu 3.  | 210 021 \$ 81. 4:              | Decade switch setting | 140 1112                    | 30 MHz       | 40 Mf.            | 199 MHz                                     |                 |                   | 199 MHz            |   |            |  |
|   | PROCEDURE                  | Continued 1. + 7   | 3. + 10,7                               | 5. + 6,85<br>+ 7.15                  | Repeat adjustment if 5. is off limits. Check if level at 🖄 ws is also available | Autom. Frequency Control (AFC) |                       | 100 MHz appr 3 dBm on Bu 40 |              |                   | Disconnect (55) ws                          |                 | <                 | Re-connect (55) ws |   |            | •  |
|   | REQUIRED TEST<br>EQUIPMENT |  |   |                                      |   |                                | Decade switch         |                             | Oscilloscope |                   |   |                 |                   |                    |   |            |  |
|   |                            | Adju   | stme                                    | nt an                                | d Test  |                                | roce<br>Da            |                             | Name         |                   |   | 4020 (<br>DECAL | (4010)<br>DE STAG | serie<br>E         | S   |            |  |
|   | Sch                        | lumber   | ger                                     | C7                                   | 8029  |                                | 13,                   | 1.78                        | X            |                   | Replacemen                                  | 210 07          | 21 A              |                    |   |            | 10/11<br>Sheet   |

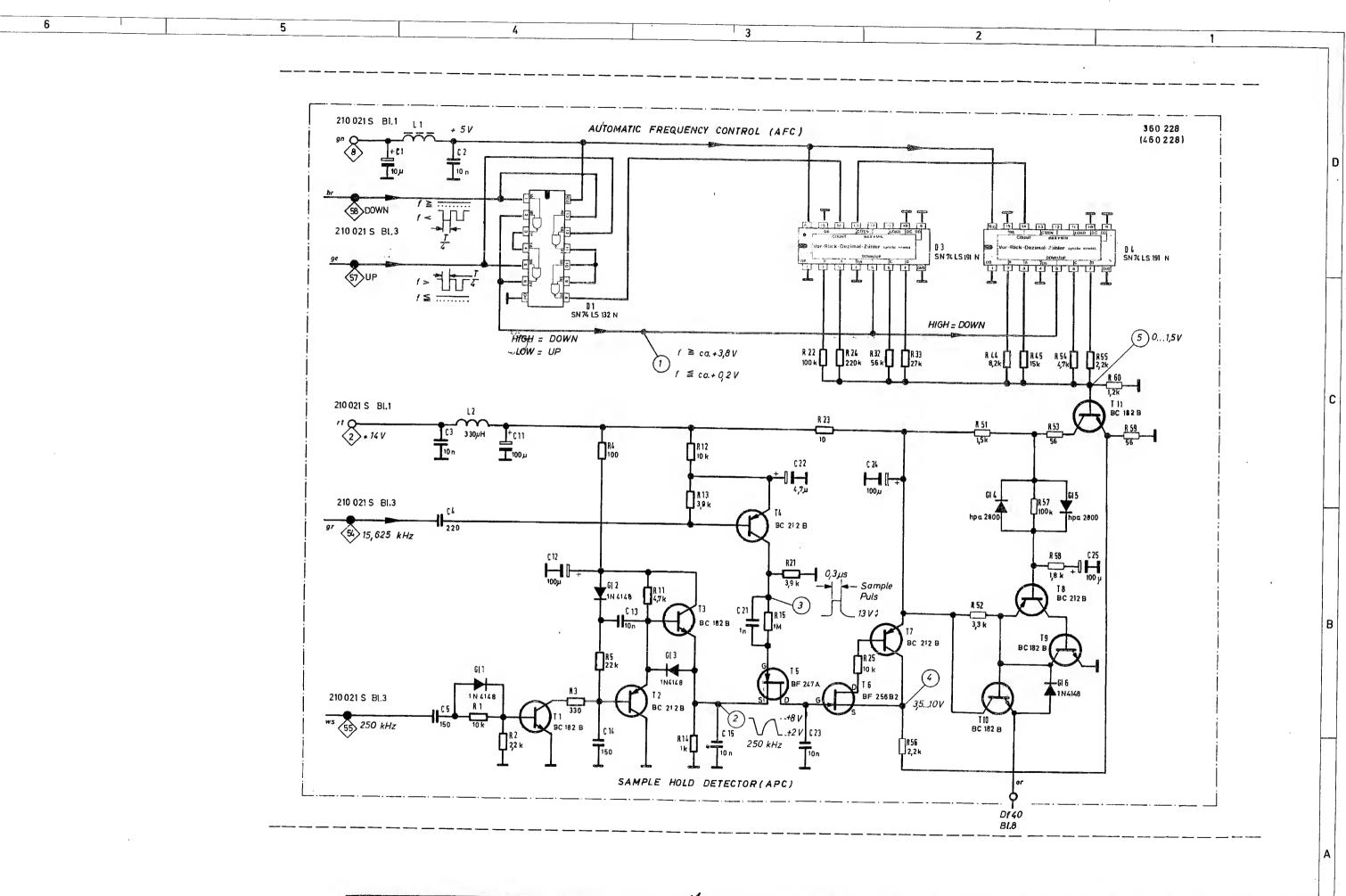
| Sch            |                     | REQUIRED TEST EQUIPMENT | PROCEDURE   | URE                                      | MEASURE         | FREQUENCY                                 | ADJUST             | REQUIRED VALUE  | MEASURED                               |
|----------------|---------------------|-------------------------|---|--|-----------------|---|--------------------|---|--|
| kumber         | Adju                |                         | Sample - Hold - Detector (APC)  | (2,                                      |                 |   |                    |   | 1014                                   |
| ger            | stme                |                         |   | Decade switch setting                    |                 |   |                    |   |  |
| 01             | Issue               |                         |   |  | ©<br>(-)        | 250 kHz                                   |                    | Sav tooth   |  |
| 8082.9         | Alteration          |                         | 100,1 MHz on Bu 40 (-3 dBm)   | 160,1 MHz                                | ©               | 15,625 kHz                                |                    | V max: 810 Vpp<br>1214 Vpp<br>Puls width at 7V              | , ok                                   |
|                |                     |                         | 100 MHz en 8u 40 (-3 dBm)   | 100,1 MHz                                | <b>(4)</b>      | oppr. 36 Hz                               |                    | Same shape as on (2)  | 0                                      |
| 2.5.75         | edur                |                         | -   |  |                 |   |                    | V max: + 9 13 V   | 0k                                     |
| 28             |                     |                         | Control Amplifier   |  |                 |   |                    |   |  |
| X<br>chuh Re   | ime                 | Counter                 | Connect 1 kg between<br>Of 40 and ground  | 102 MHz                                  | 0f 40           | 102 - 100<br>64x703x256<br>= appr. 0,2 Hz |                    | 0,2 Hz saw tooth:<br>+ 1 1,4 V = V min<br>+ 12 13 V = V max | ************************************** |
| placeme        |                     |                         | Connect Oscillator sub unit   | 40 ,480 Miz                              | 8u 35           | corresp. to<br>osc.ranges                 |                    | isatio<br>time:   | 0k                                     |
| 210 021        | 4020<br>DECA        |                         | (It can be useful to carry out the synchronisation test, when the total instrument is available).   | it the synchronisation test, available). |                 |   |                    | typical: < 1 S  | , oc                                   |
| A              | (40<br>\DE          |                         | Note: The function of the interconnecting PC board 360 174 has to be checked on the complete instrument at the following operation modes: | erconnecting PC board 360 17             | 74 has to be ch | secked on the com                         | lete instrument at | the following operation                                     | modes:                                 |
|                | 10) series<br>STAGE |                         | Frequency settings RECEIVER MEASUREMENT<br>Transmitter frequency measurement<br>Offset frequency measurement                              | TVER MEASUREMENT Gesurement Gment        | at differe      | at different Frequencies                  |                    |   |  |
|                |                     |                         |   |  |                 |   |                    |   |  |
| 11/11<br>Sheet |                     |                         |   |  |                 |   |                    |   |  |





|           | many the state of  | 440× 6+4 |                   |          | The state of the   | 750    |          | 1     |                               |               |  |     |     |
|-----------|--|----------|-------------------|----------|--------------------|--------|----------|-------|-------------------------------|---------------|--|-----|-----|
| SW BLACK  | N BLUE   | 1        |                   |          |                    |        |          | 60.   |                               |               |  | -   | -   |
| hr BROWN  | vi VIOLET  | 07       | 9028.67           | 25 9 79  | Filer              | gepr.  | 11.10.73 |       | 6.11                          | Data da Care  |  |     | 1 1 |
| rt REO    | gr GREY  | -        | +                 | 11 11.76 | We                 | hand.  | ย เกรา   | Aburg | Schlumberger o/s              | Dekaden-Stufe | 210 021 S  | BL2 | 03  |
| rs ROSE   | WS WHITE   |          |                   | 11111111 | 9711               | bearb. |          |       | Meßgerätebau u. Vertrieb GmbH |               | 1  |     |     |
| ge YELLOW | tr TRANSPARENT   | Ausg.    | ÄMittlg.          | Oatum    | Name               |        | Oatum    | Nome  | 8 München 46                  | DEMARE CTACE  |  |     | 4   |
| gn GREEN  |  | ISS.     | MOOIF.            | DATE     | NAME               |        | DATE     | NAME  | o Planeticii 40               | DEKADE-STAGE  | Typ 4010   |     | - 1 |
|           | The same of the sa | No.      | The second second | diam'r.  | THE REAL PROPERTY. |        |          |       |                               |               | 1  |     | ı   |
|           |  |          |                   |          |                    |        |          |       |                               |               | The state of the s |     |     |



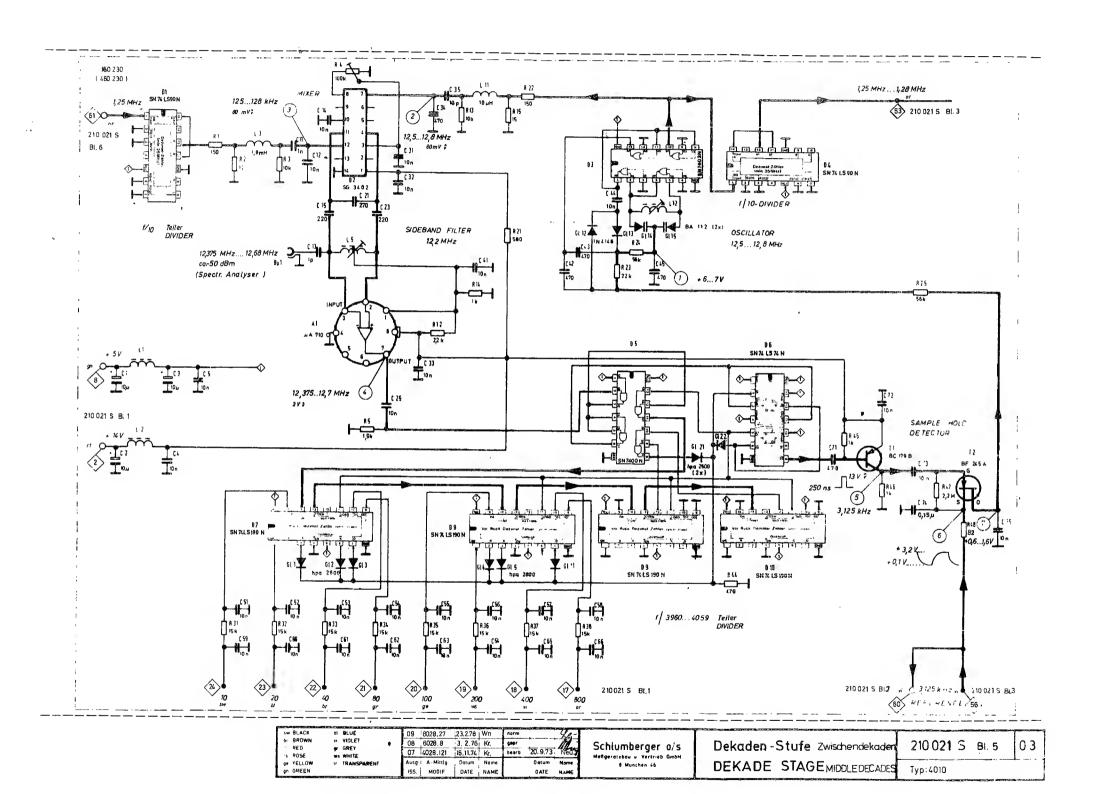


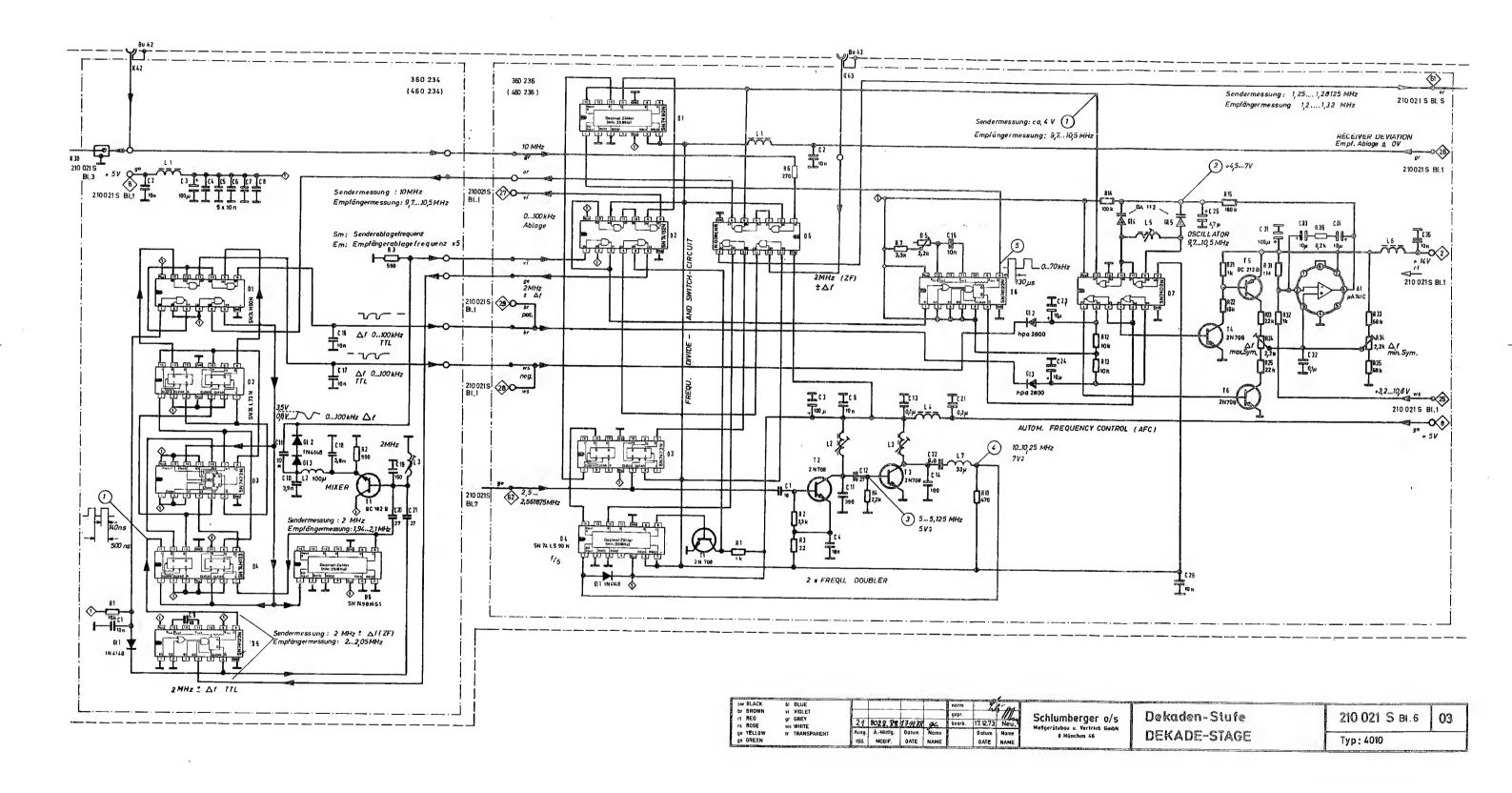
sw BLACK br BROWN rt REO rs ROSE ge YELLOW gn GREEN bl BLUE vi VIOLET 8028,67 14,7,78 Kr. 14 7028. 32 1230.77 Wn Schlumberger o/s gr GREY 13 7028.52 5.9.77 Kr. ws WHITE Ä.-Mittlg. Oatum Name tr TRANSPARENT MOOIF. OATE NAME

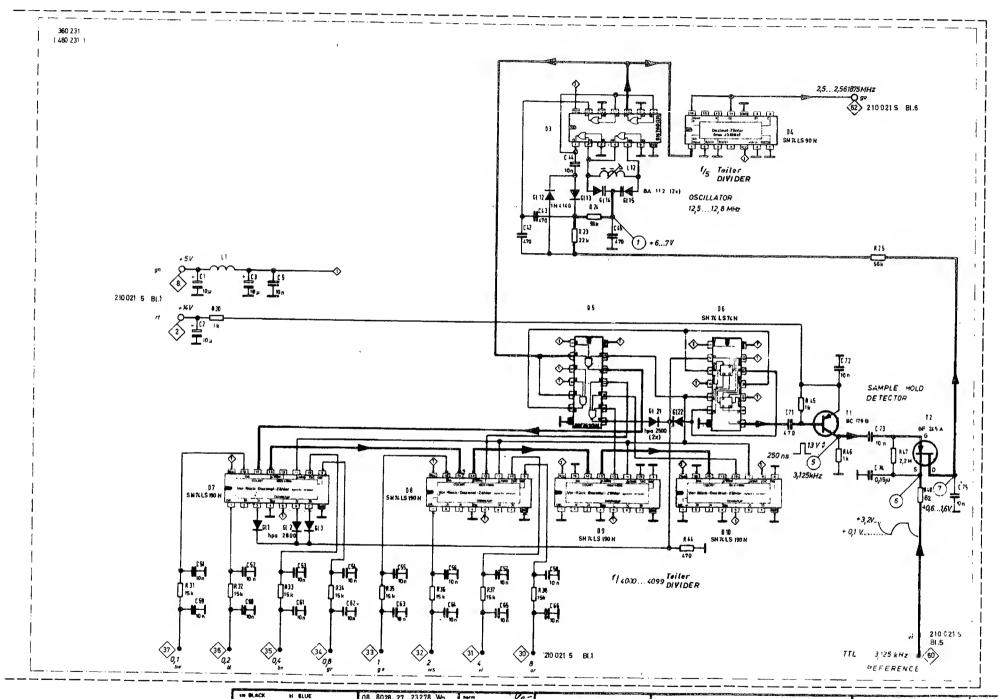
Meßgerätebau u. Vertrieb GmbH 8 München 46

Dekaden-Stufe DEKADE-STAGE 210 021 S BI. 4 03

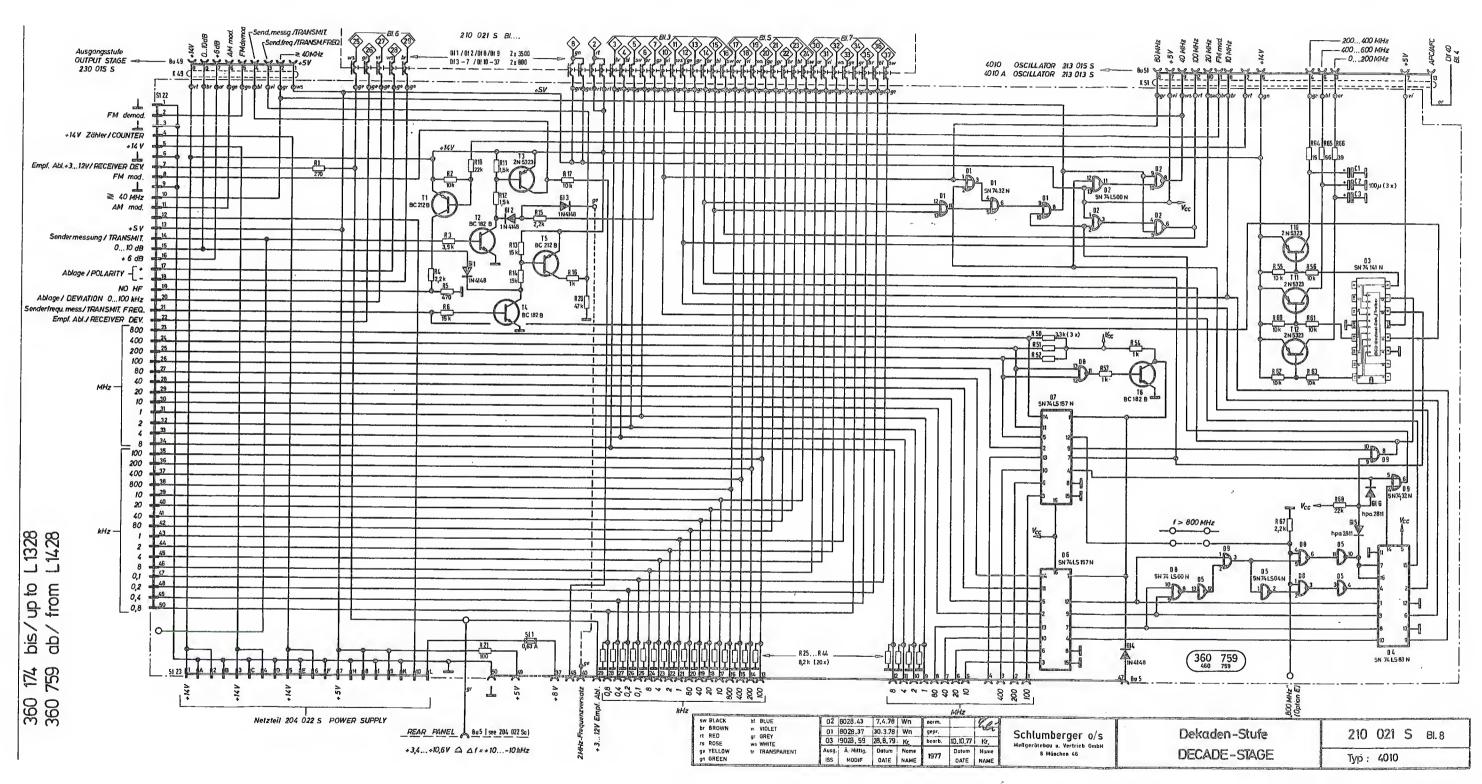
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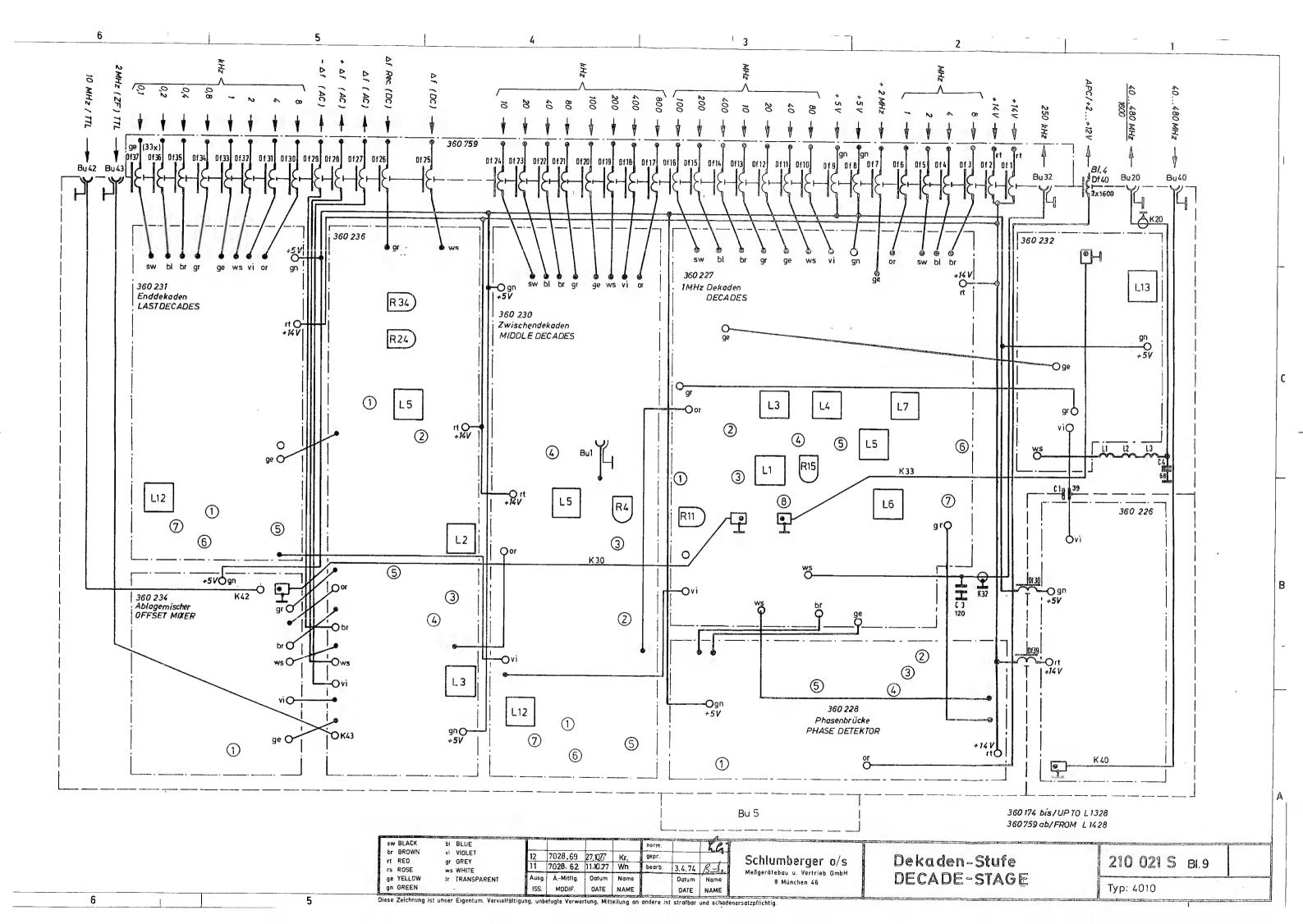




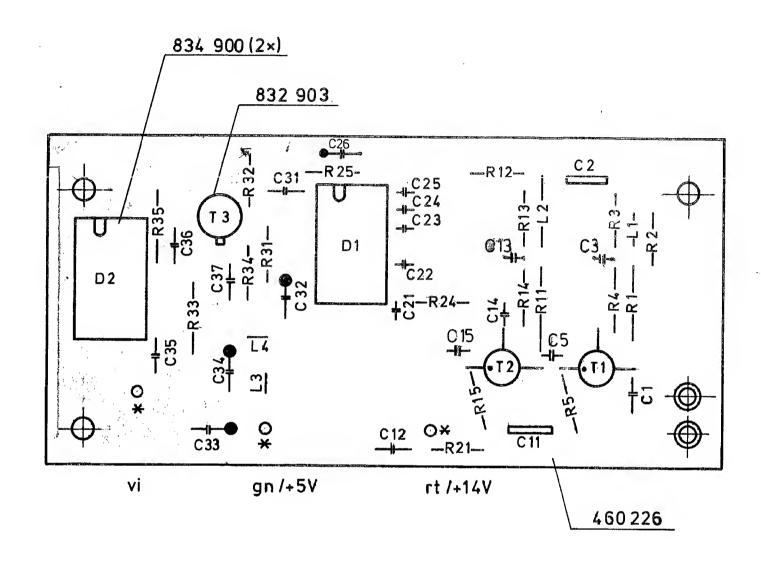
| SECOND | S

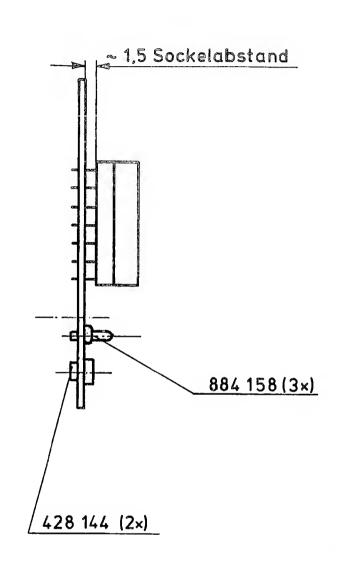


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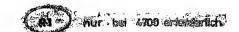


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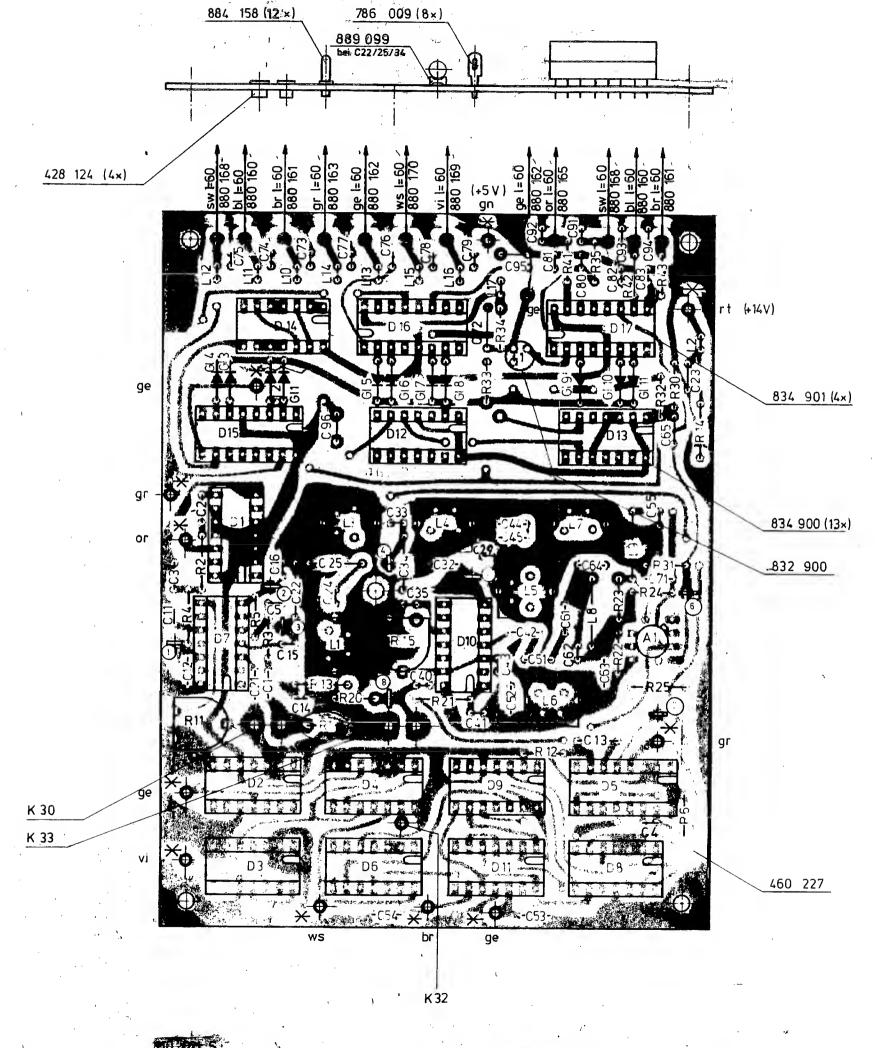
| 10<br>09<br>08<br>07<br>06   | Feinteil  Warksteil | Freimaß<br>Niedanzei | 2:1                 | Schlumberger .o/s  MeBueratetate : Vertrieb GmbH  Municipal : 46 |
|--|---------------------|----------------------|---------------------|--|
| 05<br>04 <i>9028.67 25.9.79 Eiler</i><br>03 <b>8028.92</b> 13.12.78 Mo |                     |                      |                     | Bestückte Leiterplatte   |
| 02 5028,2(21.3.75 Le P   | Operflacine         | Datum<br>yez 2114    | Name<br>Talon lower | 360 226  |

Schaltplanpositionierung = 210 0215/360 226 Sa

Gerät: 4010/4020



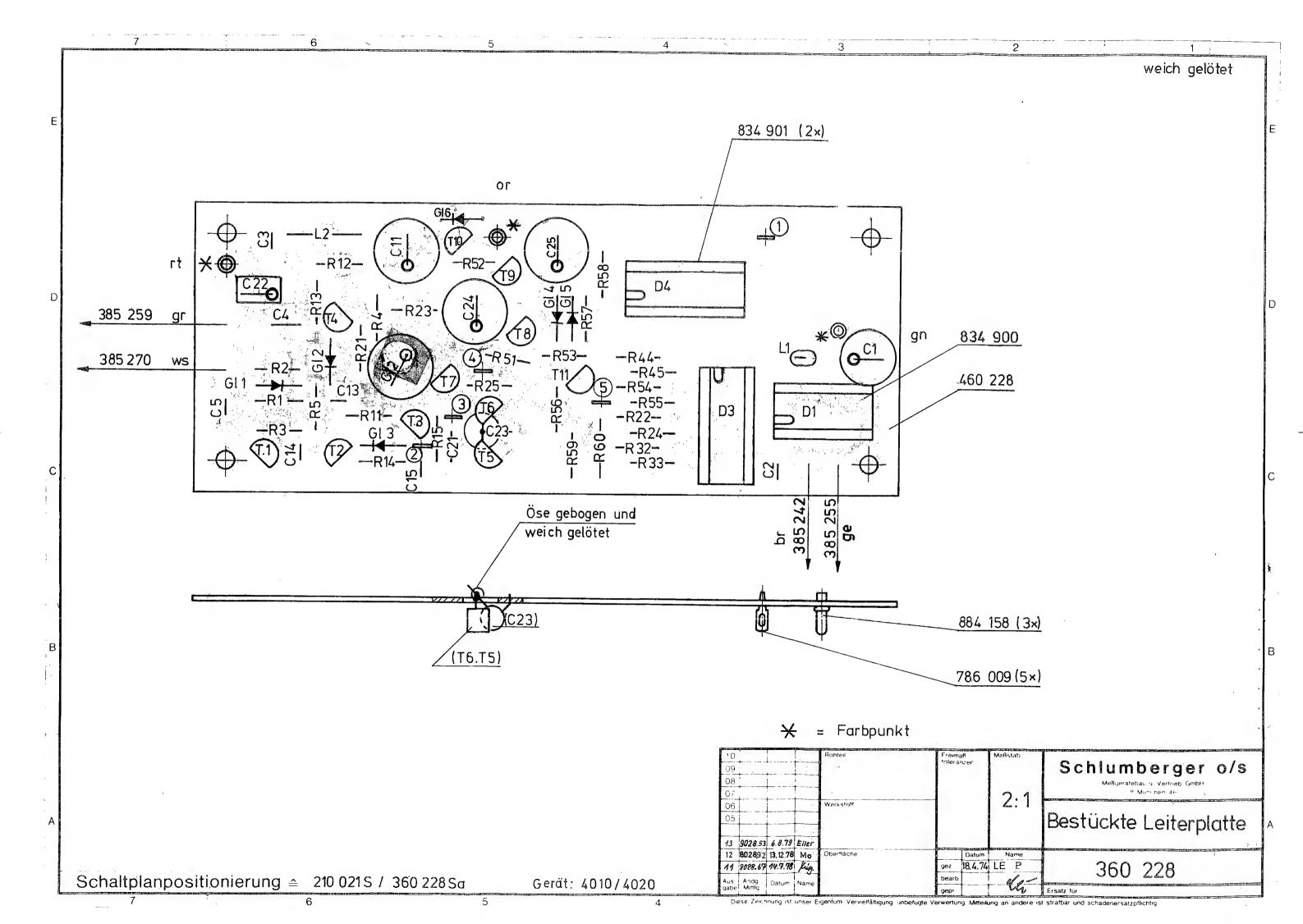
Für C22;C25 und C34 Vorschrift 099 067 V

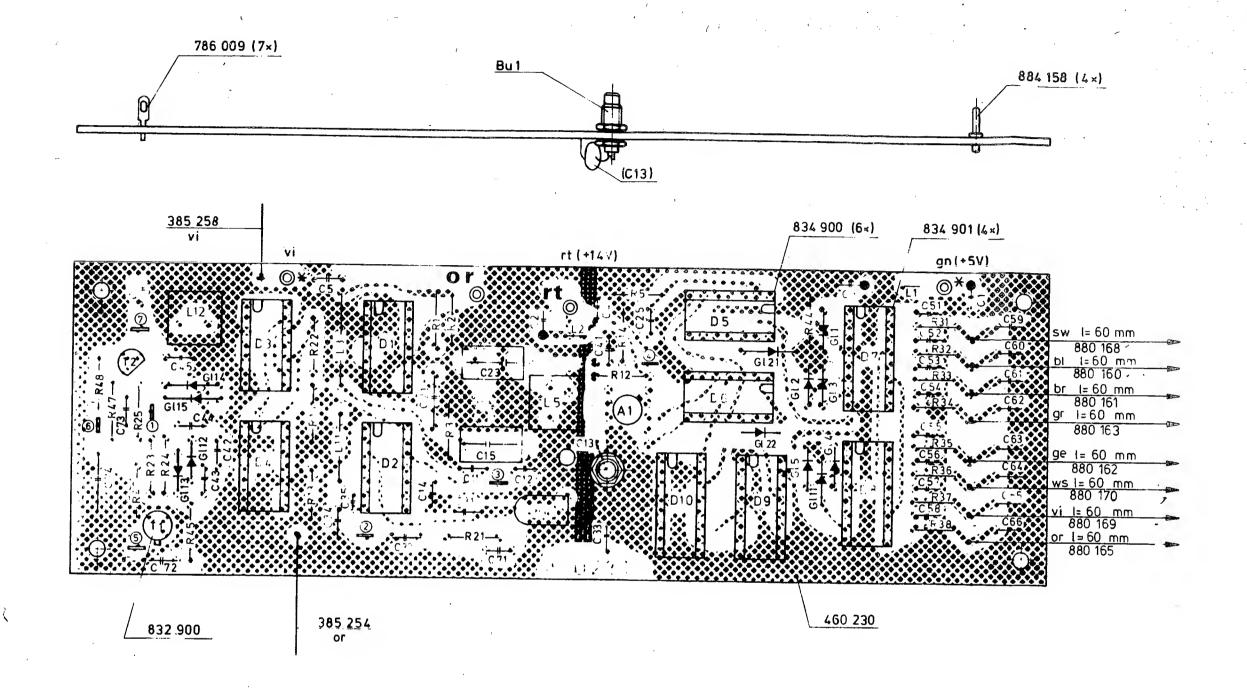


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— Kontrollmaß

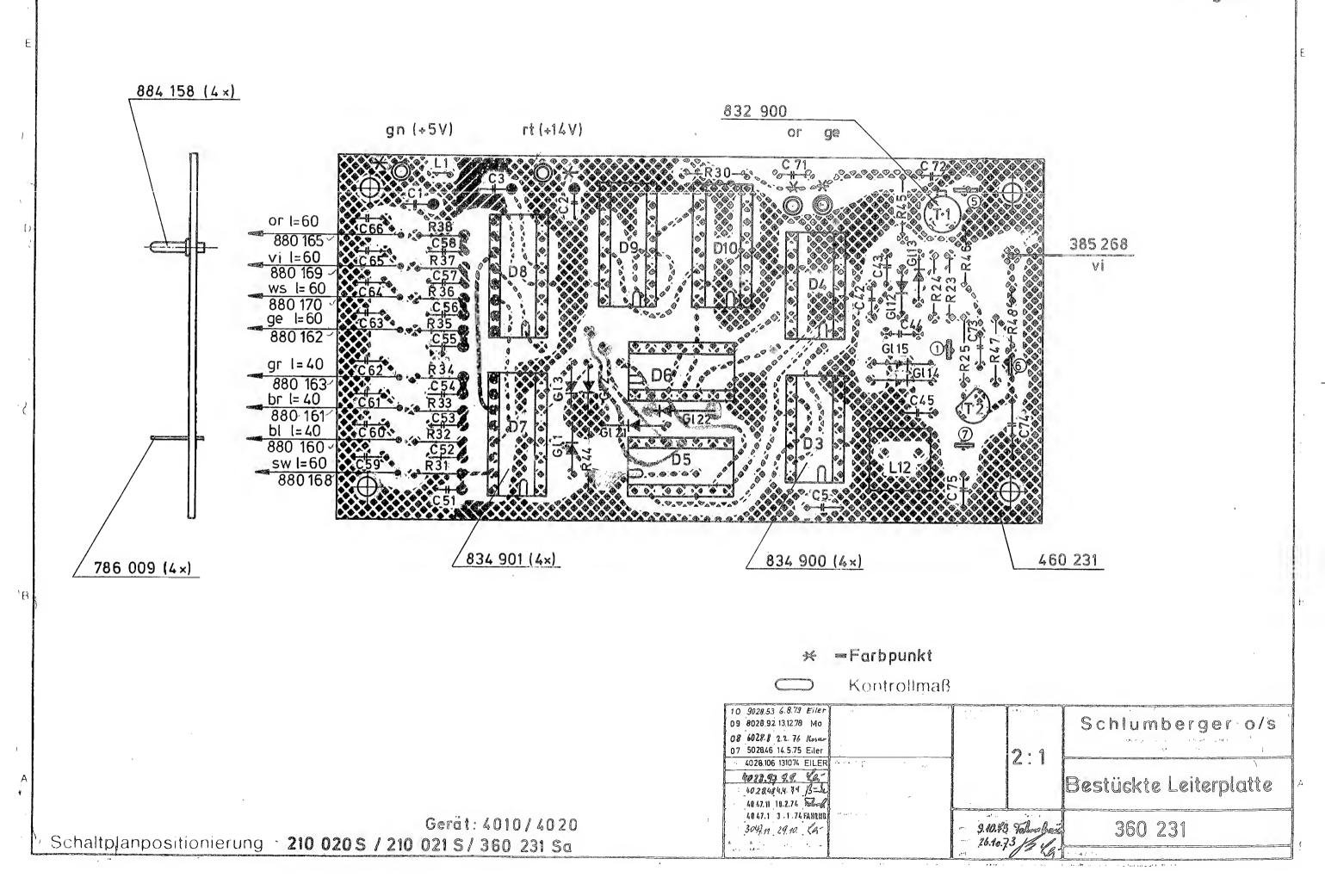
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|--|------------|-------|------|--|
| 4: 7028.53 84); V5.<br>11 6028.102 9.12.15 Eilar<br>A. Andg. Datur | viarfläche | bearb | Le P | . 360 227                                  |

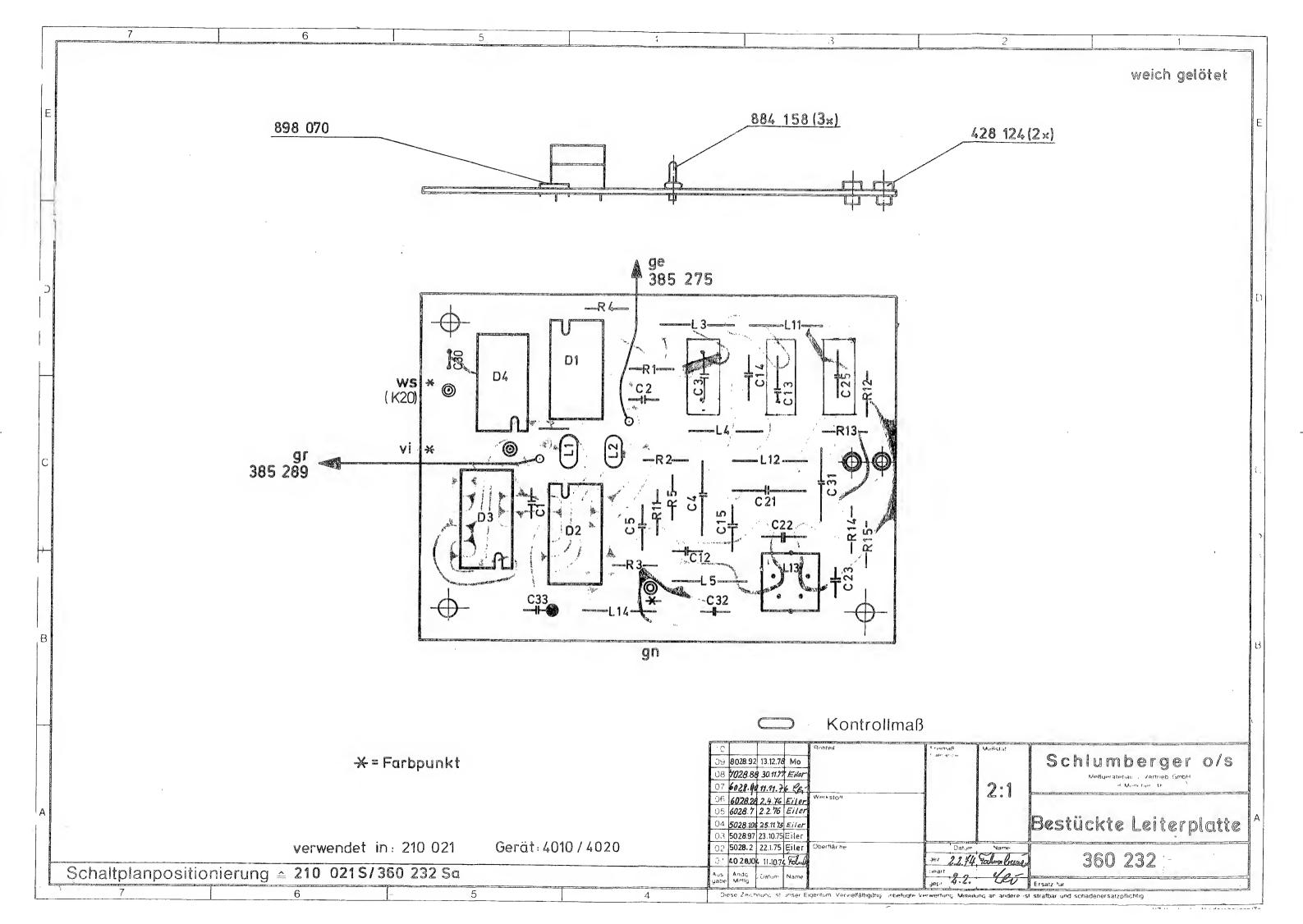


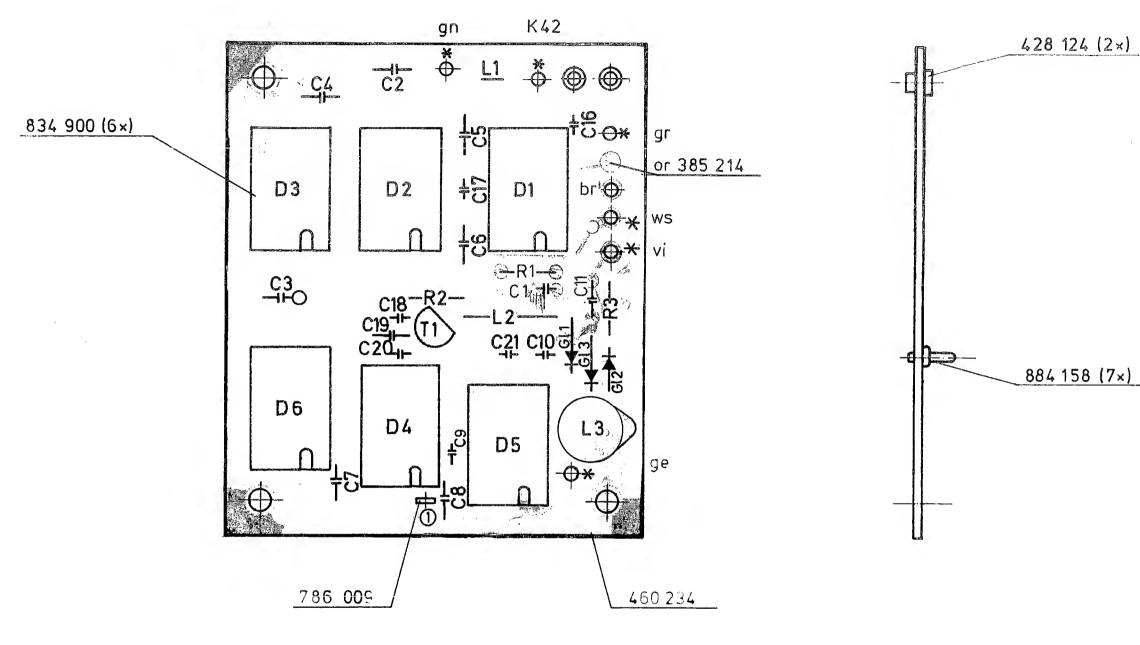


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|   | Kontrollmaß |                           |               |                        |
|---|-------------|---------------------------|---------------|------------------------|
| 16 9028.53 6 879 Eller<br>19 8028.92 13.12.78 Mo<br>08 600.51 23.70 66<br>67 6028.83 2.76 60  | B           | ···mail<br>· · · anzer    | Marksta:      | Schlumberger o/s       |
| 06 4028106 1310-74 EILER<br>05 402870 19.8.74 74 8.4.7 | ١           |                           | <i>4</i> !    | Bestückte Leiterplatte |
| 02 50 47.1 3.1.14 FARRIE. 01 3047-11 30.10. Kg- Aus. Andg Datum Name  | Oberfläche  | gez 4.0 K<br>bearb 29.19. | Name Standard | 360 230                |



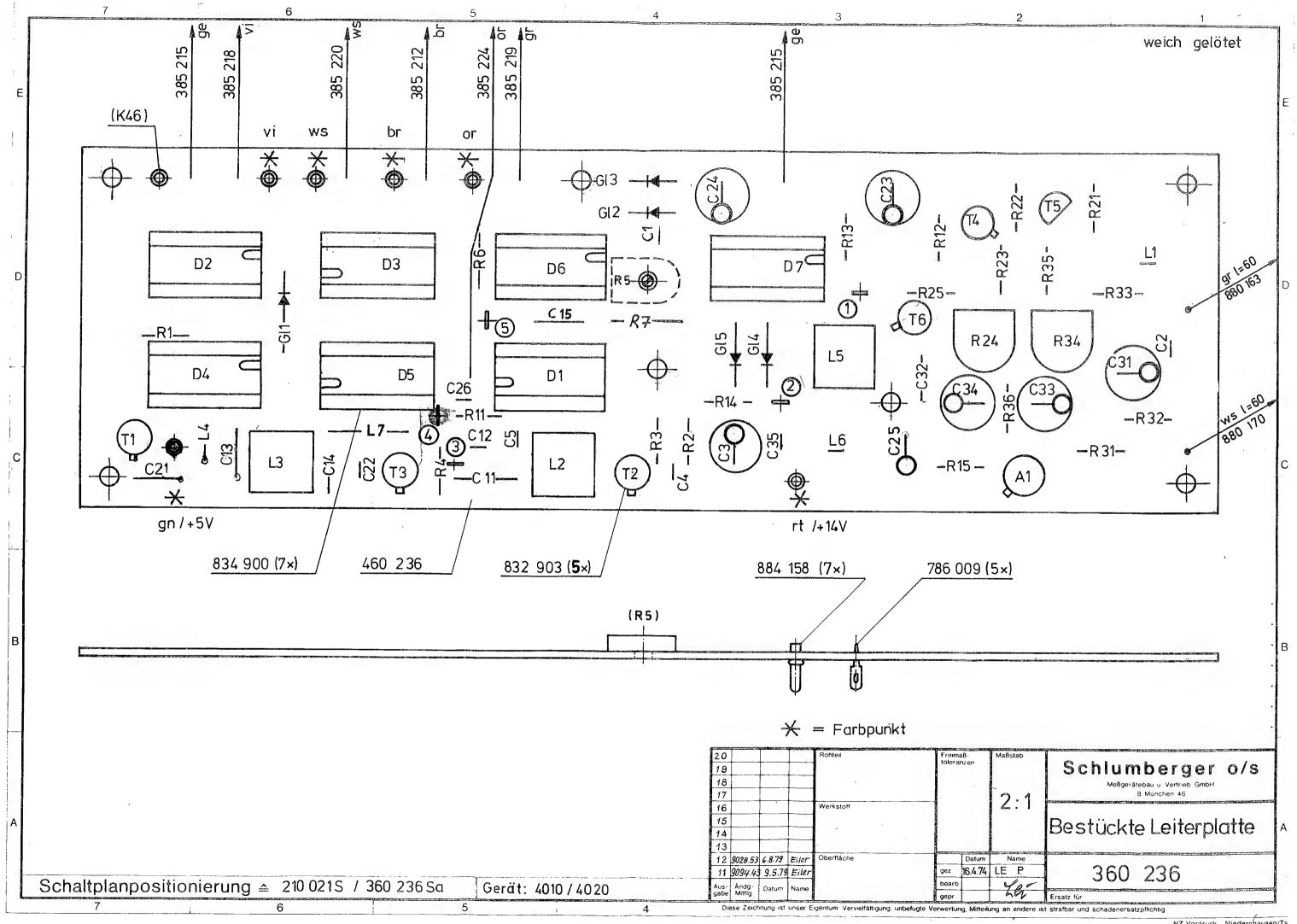


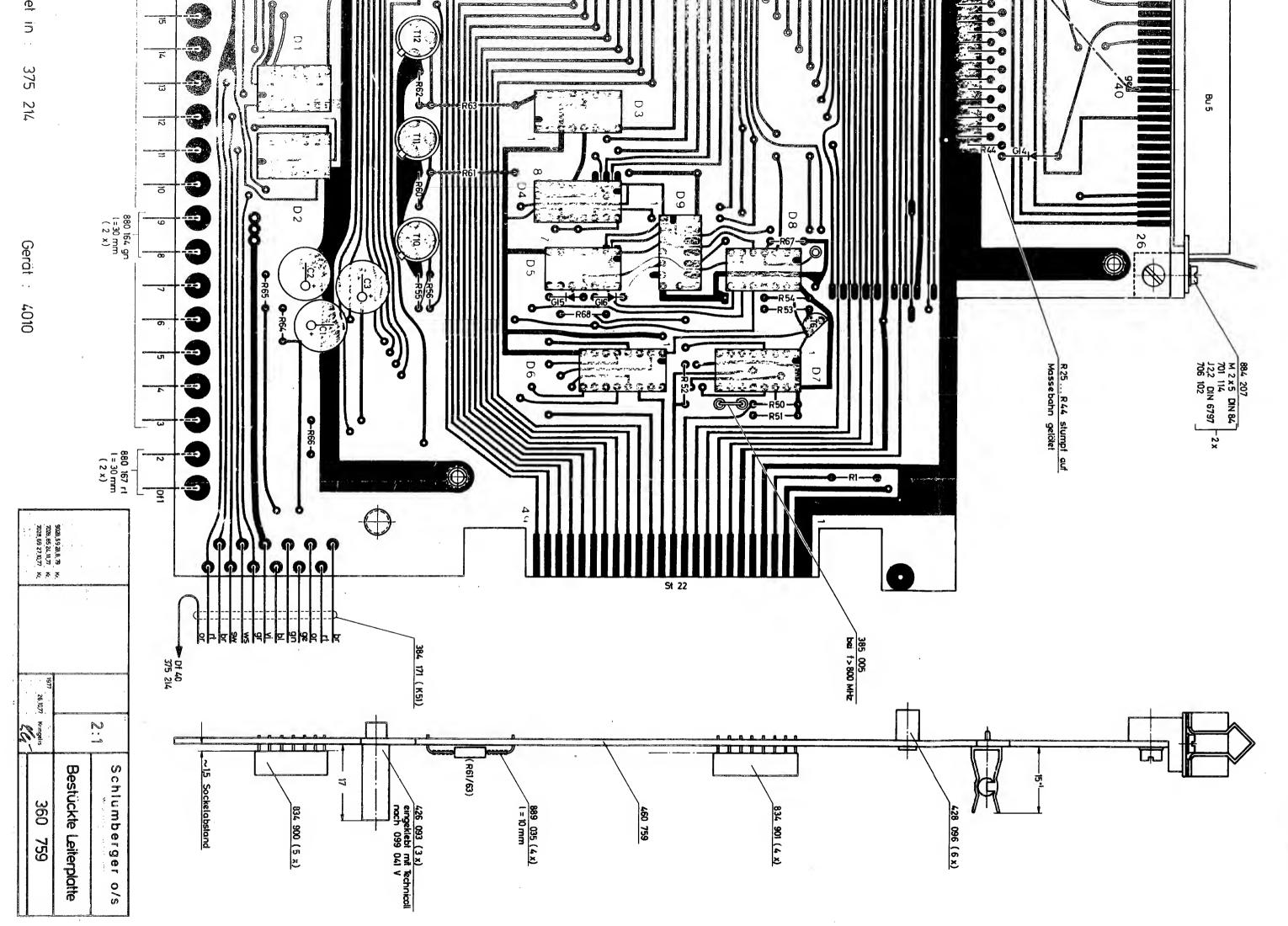


Kontrollmaß Schlumberger o/s X = Farbpunkt 2:1 05 9028 53 6.8.79 Eiler
04 8028.92 13.12.78 Mo
03 5028.2426.3.75 Le P
4028.484.4.444 Relation Bestückte Leiterplatte Typ: Ablagemischer 5274 Falmbais 360 234

Schaltplanpositionierung 210 021S/360 234 Sa

Gerät: 4010/4020





(See block circuit diagram 102 820 B for total instrument)

#### 1. Receiver Measurement

The RF signal arriving from the oscillator stage is routed to the "RF direct" output through a AM modulator with ALF control and 2 variable attenuators for adjusting the EMF.

A mixer is included for the frequency range 0....40 MHz.

#### 1.1 AM Modulator

Here, an auxiliary modulator which provides a signal level sufficient for satisfactory rectification is amplitude modulated in the usual way by means of the differential amplifier and feedback through "AM(AC)". This ideally modulated signal is then presented to a reference rectifier through a voltage attenuator, the former having the same properties as the EMF rectifier. The signals from the reference rectifier and the EMF rectifier than are applied to a differential amplifier, which controls a pin diode attenuator. This results in compensating non-linearities and temperature effects occurring during rectification of small RF levels.

The modulator output level is automatically controlled in non-modulated operation also and can be elevated by +6 dB by increasing reference level.

## 1.2 EMF Adjustment

The EMF level is adjusted by means of a mechanically switchable attenuator pad in 10 dB steps. For fine adjustment the DC voltage "EMF(DC)" controls a pin diode attenuator pad through a linearizing network according to the meter indication +2....-10 dB.

A 16 dB UHF amplifier is inserted when the 2V EMF range is selected.

## 1.3 0.....40 MHz Mixer

The fixed LO frequency of the ring mixer 140 MHz is derived directly from the crystal frequency by means of a frequency multiplier. The amplitude controlled synthesizer signal of 140...180 MHz is switched by a relais at the linear input, the de-mixed product being routed through a low pass filter and a RF amplifier to compensate the attenuation caused by the mixer.

|              | Function | n Description | 230 025 F    | Sheet 1/2 |
|--------------|----------|---------------|--------------|-----------|
| Schlumberger | Type:    | 4020/21/22    | Output Stage | Date 0979 |

### 2. Transmitter Measurements

The AM Modulator and the EMF vernier control are adjusted to maximum level by the control and display unit to enable the subsequent IF mixer to fully present the synthesizer frequency. The transmitter signal for the other mixer input must be previously controlled to a suitable mixer input level in the input amplifier with its large difference in level (from 1 mV to 3.5 V). In this automatic level control circuit the rectifier diode on the amplifier output controls the input pin diodes, an additional control being provided for higher performance.

The ALC controlled transmitter signal is routed through the control line "TR Frequ. (DC)" to the oscillator stage when measuring transmitter frequency. Switching diodes, placed inside of the connecting cable are also controlled by these means to eliminate cross-talk in other modes of operation.

# 2.1 The Intermediate Frequency

The mixed product is presented to the FM discriminator through various band filters and limiting amplifiers. A DC coupled discriminator output is led to the front panel socket AUX OUTPUTS. The active 20 kHz low pass filter at the output end supplies the demodulated signal "FM TR (AC)" through the decade stage to the meter circuitry. The squelch provided at the output end of the first limiting amplifier is provided with 2 chain inverters in parallel having different threshold levels. The chain inverter having the high sensitive threshold voltage provides a 2 MHz TTL signal even at low level input for frequency display through the decade stage. The chain inverter having low threshold sensitivity presents the IF to the following band pass filter once the level is sufficiently high to eliminate a noisy erroneous indication of modulation.

|              | Function Description | 230 025 F   | Sheet2/2  |
|--------------|----------------------|-------------|-----------|
| Schlumberger | Type: 4020/21/22     | Ouput Stage | Date 0979 |

| Sch                       |                          | REQUIRED TEST<br>EQUIPMENT | PROCEDURE                                      | MEASURE      | FREQUENCY | ADJUST | REQUIRED VALUE                    | MEASURED |
|---------------------------|--------------------------|----------------------------|--|--------------|-----------|--------|-----------------------------------|----------|
| nlumbe                    | Adju                     |                            | Frequency Multiplier 10140 MHz 230 025 S Bl. 4 |              |           |        |                                   | AALUE    |
| rger                      | istme                    | w <sub>0</sub>             | Frequency setting: < 40 MHz                    | 8u 4         | 10 MHz    | 8<br>8 | 10 MHz TT!                        |          |
|                           | lss                      | Power Meter                |  | <del>-</del> | DC        | 4      | appr. 7.1 V                       |          |
| - 0                       | -                        |                            | ( 500 ) Analyser to Bu 1                       | Bu 1         | 140 MHz   | 0 0 0  | Suppression of                    |          |
| 0028_ 29                  | Test F                   | Analyser                   | Power Meter to Bu 1                            | Bn 1         | 140 MHz   |        | Spurious > 65 dB<br>-3 to + 3 dBm |          |
| 27.3.80                   |                          | Orosad:                    |  |              |           |        |                                   |          |
| Morasch                   | Name                     | uro.                       |  |              |           |        |                                   |          |
| 230 025 A Replacement for | 4020 series OUTPUT STAGE | /.020 acciden              |  |              |           |        |                                   |          |
|                           |                          |                            |  |              |           |        |                                   |          |
| 1/7<br>Sheet              |                          |                            |  |              |           |        |                                   |          |

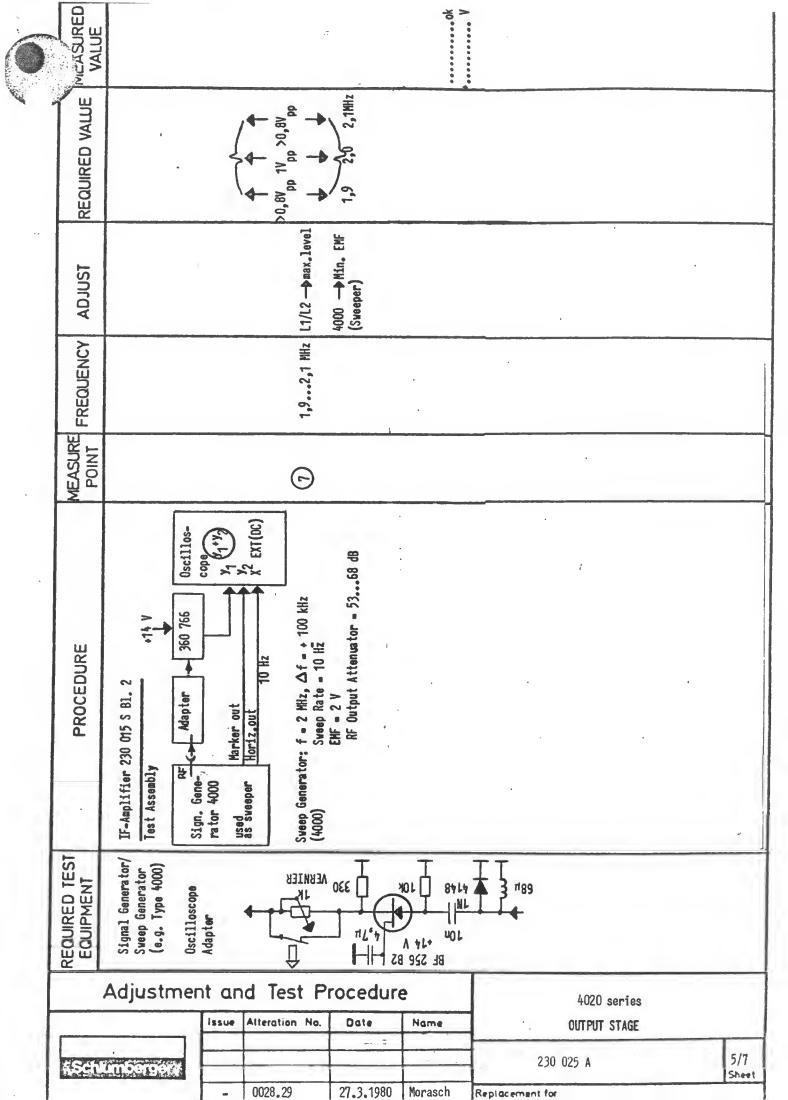
| Schl                  |                       | REQUIRED TEST<br>EQUIPMENT | PROCEDURE   | MEASURE      | FREQUENCY      | ADJUST  | REQUIRED VALUE            | MEASURED   |
|-----------------------|-----------------------|----------------------------|---|--------------|----------------|---|---------------------------|------------|
| umberger              | Adjustme              |                            |   |              |                |   |                           |            |
| -                     | nt ar                 |                            |   |              |                |   |                           |            |
| 0028.2                | Alteration            |                            |   |              |                |   |                           |            |
| 9                     |                       |                            | ENF and Power Indication Meter.   |              |                |   |                           |            |
| 26.                   |                       |                            | Check out of mechanical zero setting  |              |                | meter I 3                                       | zero deflection           | Åo         |
| 3.1980                |                       | WAQ .                      | Adjust Pointer to full-scale deflection by aid of the EMF control knob on the front panel and check potential at  | 0f3          | ၁၀             | R 306   | 9,5 VDC                   |            |
| Moraso                | Name                  |                            |   |              |                | 360 154   |                           |            |
| ch Replaced           |                       | ·                          | Pre-set all trimmer potentiometers on 360 761 and 360 762 to mid-position, except R 34. R 34 adjust to 2/3 fully anti-clockwise. Pre-set C 9 to minimum capacity. |              |                |   |                           | -2         |
| nent for              |                       |                            | Flatness of RF Signal   |              |                |   |                           | 200        |
| 230                   |                       | Power Meter                | Adjust EMF—indikation by front panel controls to +83 dBµV (+83 dBµV ≈ -30 dBm)  | RF<br>output | 40 to 200 MHz  | R 42 / 360 761<br>R 72 / 360 762                | - 30 dBm <u>+</u> 0, 4 dB | 80         |
| 025 A                 |                       |                            |   | (N-socket)   |                | Don't change R 42  <br>if level is below-30 dBm | 30 dBa                    |            |
|                       | 20 series<br>IT STAGE |                            |   |              | 400 to 479 MIZ | R 21  | - 30 dBm ± 0,4 dB         | gp · · · · |
| 2 <b>/</b> 7<br>Sheet |                       |                            |   |              |                |   |                           |            |
|                       |                       |                            |   |              |                |   |                           |            |

|              | 1                        |  | ×  |   |                           |  |  |                   |
|--------------|--------------------------|--|--|---|---------------------------|--|--|-------------------|
| &Schle       | /                        | REQUIRED TEST<br>EQUIPMENT                   | PROCEDURE  | MEASURE                                       | FREQUENCY                 | ADJUST   | REQUIRED VALUE   | MEASURED<br>VALUE |
| imbergec     | Adjustmen                | Modulation Meter<br>Dist, Analyser           | AM Distortion Adjustment (Negative AM swing)   | RF-socket<br>(front<br>panel) or<br>RF DIRECT | 479,99 MHz<br>mod = 1 KHz | R 34 / 360 762<br>to minimum<br>distortion at<br>95 % AM depth | <22 % typical 1 %  | 84                |
| -            |                          |  | Check RF Flatness again  | е   | 39.0.479,9 MHz            | R 72   | - 30 dBm ± 0,4 dB  | gp.               |
| 0028.2       | d Te                     |  | Mixer (140180) - 140 - 0,40 MHz  |   |                           |  |  |                   |
| 9            |                          | (Signal Generator                            | RECEIVERMEASUREMENT Set EMF step attenuator to + 80 dBuy,  |   | C 6 mid-pos.              |  |  |                   |
| 27.3.80      | ocedure<br>Date          | RF Power Meter 0, C1 40 MHz (or RF Analyser) | Frequency setting 0,1 MHz 0,0139,9 MHz   | Bu 13   | 0,1 MHz<br>10 KHz39,9MH   | C 8 2  | - 30 dBm<br>minimum Flatness<br>(Notice low frequency  |                   |
| Morasch      | Name                     | Analyser                                     | Set EMF control knob to 10 mV indication<br>Pay attention to the following spurious signals, which   |   |                           |  | cutoff of the Power<br>Meter)<br>Non harmonic Spurious   | Signals           |
| Replaceme    |                          |  | can be expected: Signals with variable distance, passing the carrier at 28 MHz and at 35 MHz. 60 MHz signal, occuring when the carrier is set to 40 MHz. | 560   |                           |  | U. 25 MHz: > 63 dBc > 25.40 MHz: > 53 dBc > 14.40 MHz: > 53 dBc > 14.40 MHz: > 50 dBc > 14.40 MHz > 30 dBc > 14.40 MHz > 30 dBc > 14.40 MHz > 14.40 MH | \ dBc \           |
| nt for       |                          |  | EMF + 6 dB Switch over   | RF-socket                                     | 150 MHz                   | R 35 / 360 761   | 4 6 dB + 0,4 dB  | qB                |
| 230 025      |                          |  | Press and depress *+ 6 dB push button*   |   | 40 to 479,9 MHs           |  | + 6 dB + 0,4 dB  | y0*****           |
| 5 A          | 120 series<br>IPUT STAGE | AC-DVM                                       | AM Depth Adjustment<br>at 70% depth and f mod 1 kHz  | Df 6  | 1 kHz                     | Control knob   | 2,1 VAC  | >                 |
| 3/7<br>Sheet |                          | Modulation Meter                             |  | Socket<br>RF or<br>RF DIRECT                  | 100 kHz.,479,9            | to 70 % AM<br>Indication<br>R 44<br>(360 761)                  | 70 % + 5 %<br>AM TEPTH   | 82                |



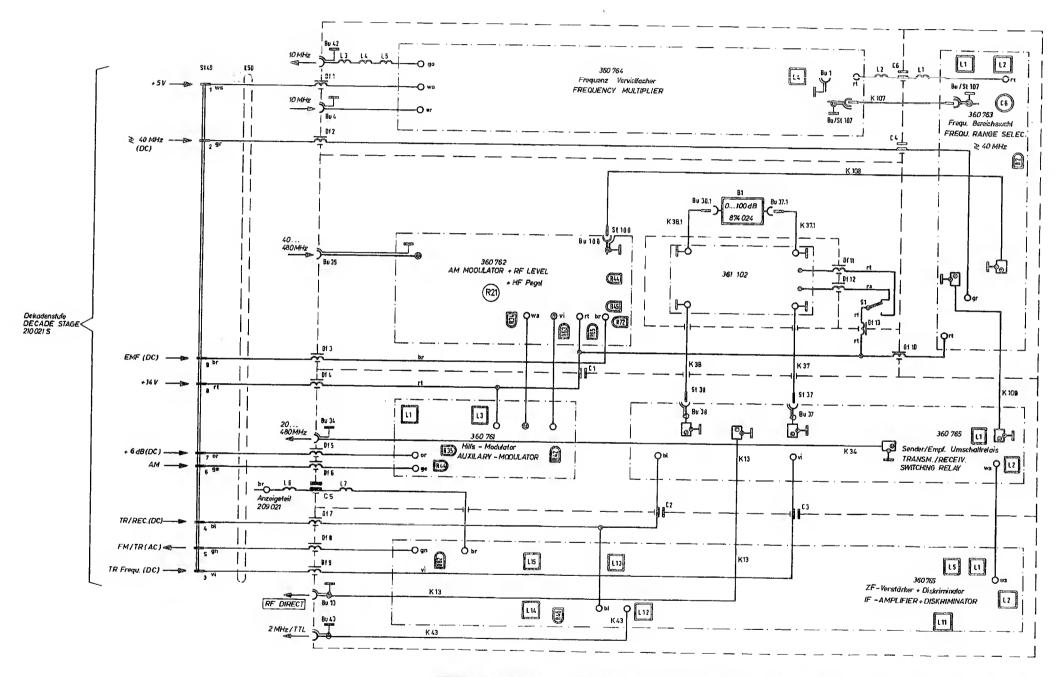
| - | 140  |         |
|---|------|---------|
|   | Cara | 250     |
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|   | 1    | 0.7     |
|   | 0    | ST. ST. |
|   |      |         |

|          | Den and and |   |             |             |                   |  |          |
|----------|-------------|---|-------------|-------------|-------------------|--|----------|
|          | EQUIPMENT   | PROCEDURE   | MEASURE     | FREQUENCY   | ADJUST            | REQUIRED VALUE                         | MEASURED |
| Adjust   | 100 d       | Linearization of EMF Setting Set attenuator on front panel to * 80 dBpV   |             |             |                   |  |          |
| me       | TOYOL MOTOL | and EMF Control to indication + 3 dB  | RF-socket   | t 180 MHz   | R 72              | = 30 d8m                               |          |
| eni      |             |   | <b>10</b> 1 |             | R 65              | - 35 dBm                               |          |
| t c      |             | SD C +  | -           | -           | Test              | - 30 dBm                               |          |
| ınd      |             | 8   | ar i        | -           | R 63              | - 40 dBm                               |          |
| d '      |             | 80 7 -  | -           | -           | Test              | - 35 dBm                               |          |
| Tes      |             |   | * (         | ==          | R 45              | - 29 dBm                               |          |
| st       |             | 88 5 +  | -           | SE .        | Test              | - 30 dBm                               |          |
| Pr       |             | Va 9th  | 82 0        | <b>a</b>    | . R 53            | 9,5 mV into 50 a                       |          |
| oc       |             | Vm 21   |             | n a         | R 53              | - 28 dBm                               |          |
| e        |             |   |             |             | rest              | 7,5 mV into 50 a                       |          |
| ut       |             |   |             |             |                   | Error < 0,1 dB                         | yo       |
| re       |             | Power Flatness at meter deflections - 7 and + 5 dB Attenuator setting to + 80 dBµV EMF meter deflection - 7 dB + 5 dB | Die Die     | 40 479,9Miz | check             | - 40 d8m + 0,8 d8<br>- 28 d8m + 0,8 d8 | db.      |
|          |             | Auxiliary Modulator (360 761)   | 230 025 S   |             | R 35, 40, 44      |  |          |
| 4020 sei |             | . Disconnect the counter  | BJ. 3       |             | - Middle position |  |          |
|          |             | -   | 90          | ZHU 07      | L 3               | Miniaum of the                         |          |
|          |             |   |             |             |                   | AGC voltage + 11 <sub>5</sub> V        | <b>A</b> |
|          | •           | _   | _           | -           |                   | Residence                              |          |

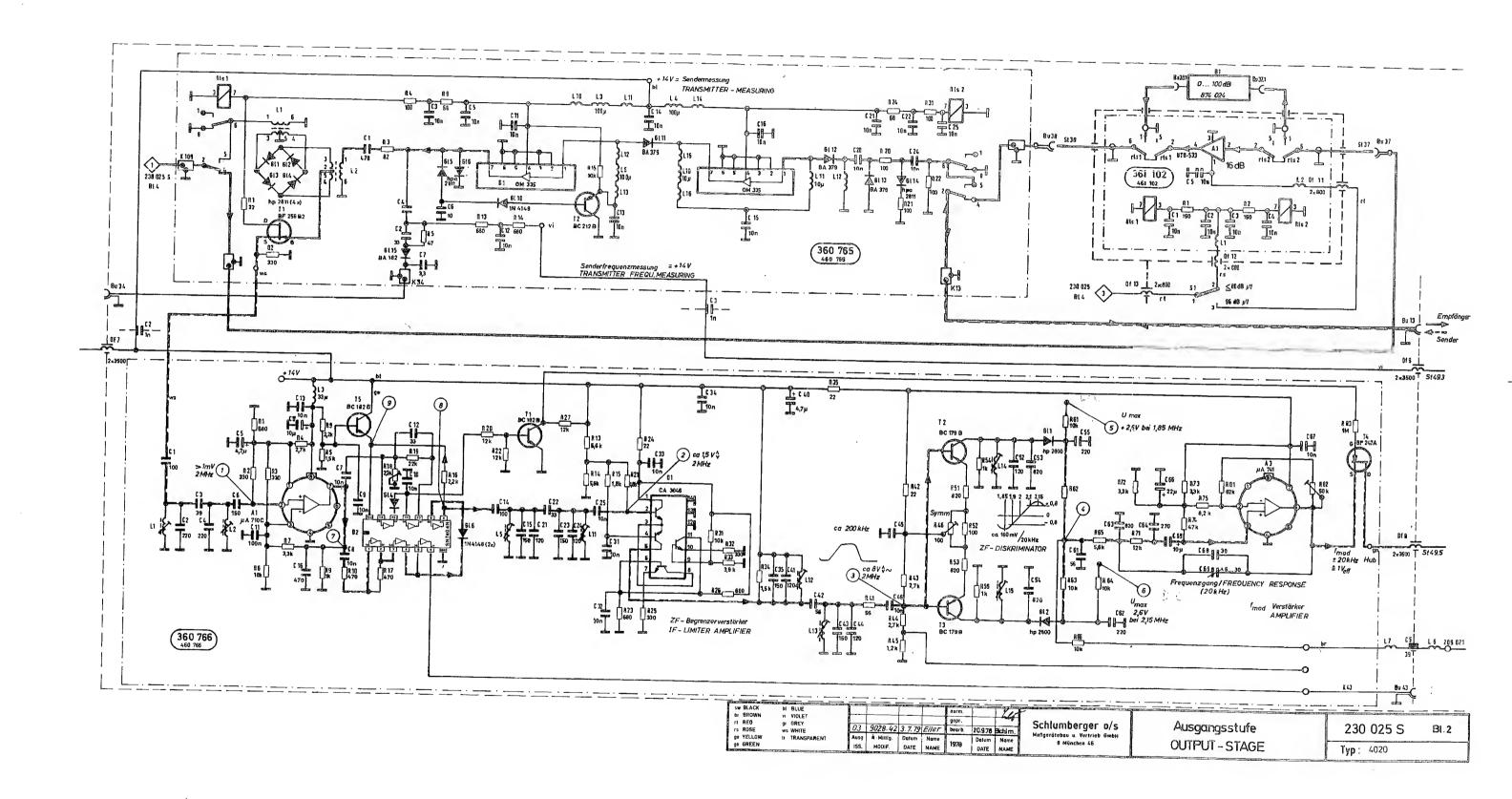


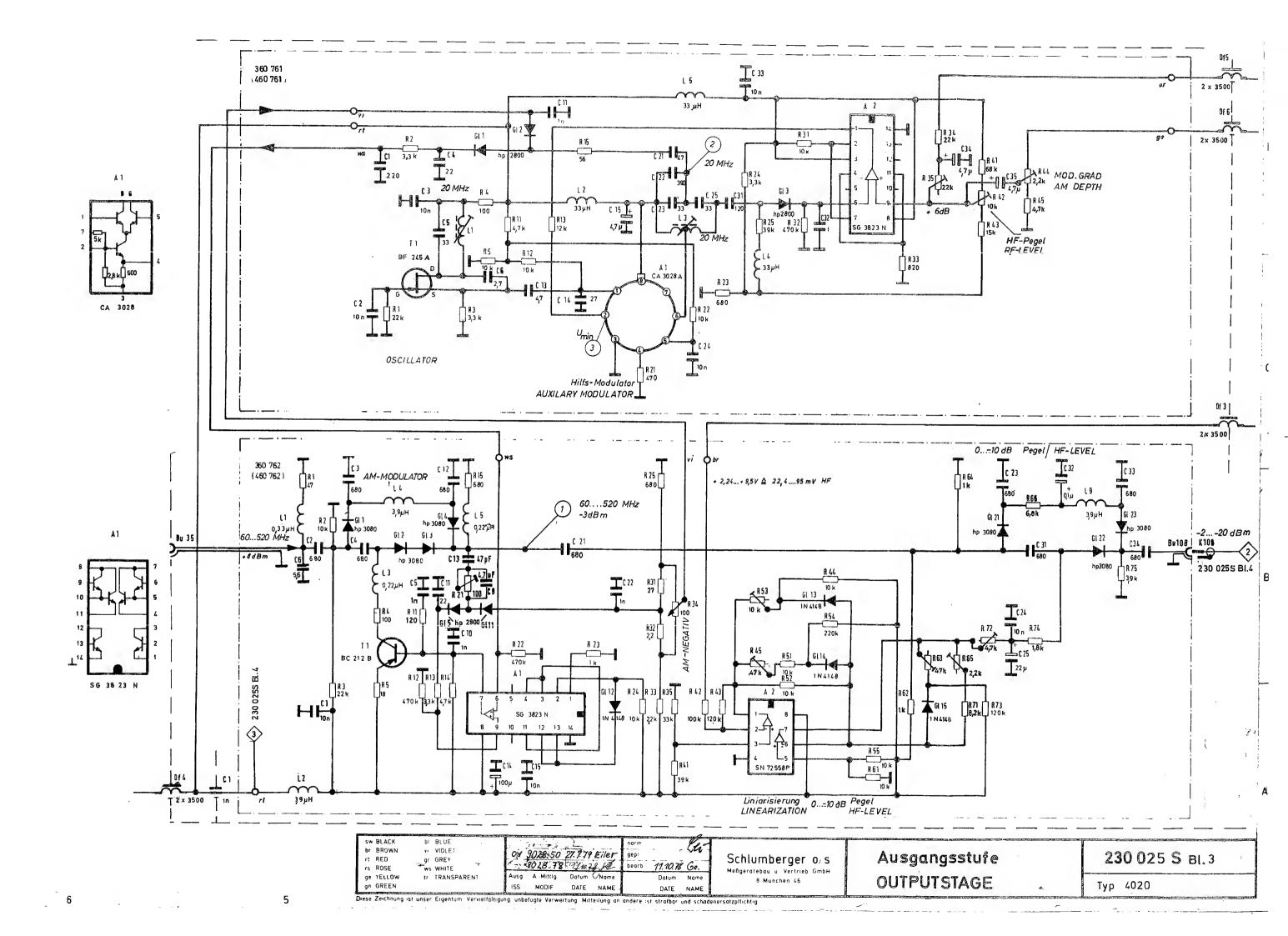
| MEASURED VALUE             |   |  |  | ,  | KHZ                        |   |               |                     |  | 0, V PP -2. V O. V O. V  |
|----------------------------|---|--|--|--|----------------------------|---|---------------|---------------------|--|--|
| REQUIRED VALUE             | - \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | <u></u>  |  | 1,8 2 2,2MHz   | 40 70 kHz                  | ve 79 V   |               | -23 V               | 4  | 1,8 1,965 2 2,035 2,2<br>Max_Level=7,58,5 Vp<br>Aup from 1,965 MHz<br>up to 2,035 MHz<br>< 0,1 V<br>< 2,42,8 V<br>- 2,42,8 V<br>- 2,42,8 V |
| ADJUST                     |   | 15, L11—Max_level  |  |  |                            | L12/L13+Hax.RF lovel 79 V   | L14           | L15 → Max. DC       | L12/L13  | L14 — Max. DC L15 — WC 0/2 L15 — VDC 0-0 V   |
| FREQUENCY                  |   | 0,91,1 MHz L5, L11-  |  |  |                            | 2 Mrz   | 1,85MHz       | 2,15 Miz            | 1,82,2,MHz   | 1,85 附z<br>2,15 附z<br>2 附z   |
| MEASURE                    |   | ©  |  |  |                            | 0   | (S)           | <u></u>             | <u>©</u>   | ©@@  |
| PROCEDURE                  | IF Limiter Amplifier (360 766)          | 4000: 1 MHz, 2 V EMF, Attenuator = 0 dB<br>Sweep Deviation + 100 kHz, Sweep Rate = 10 Hz | (Due to its high input level, the adapter is | operating as a frequency doubler now. Available sweep deviation is increased to \$ 200 kHz.) | IF Discriminator (360 766) | Set R 46 to mid position 4000: 1,852,15 MHz, 2 V EMF, 0 d8, UNNOD | without SWEEP | Vernier adjustments | 4000: 1 MHz, 2 V EMF, 0 dB, UNMOD, SWEEP + 100 kHz | 4000: 1,852,15 WHz, 2 V EMF, 0 dB, UNMOD,without SWEEP   |
| REQUIRED TEST<br>EQUIPMENT |   |  |  |  |                            |   |               |                     |  |  |
| ,                          | Adjus                                   | tmer   | t ar   | 7  | est f                      |   |               | e<br>Na             | ne   | 4020 series OUTPUT STAGE   |
| SGN                        | inpers                                  | era  | •  | 0028.  | 29                         | 27.3.   | .1980         | Mor                 | asch   | 230 025 A 6/7<br>Sheet   |

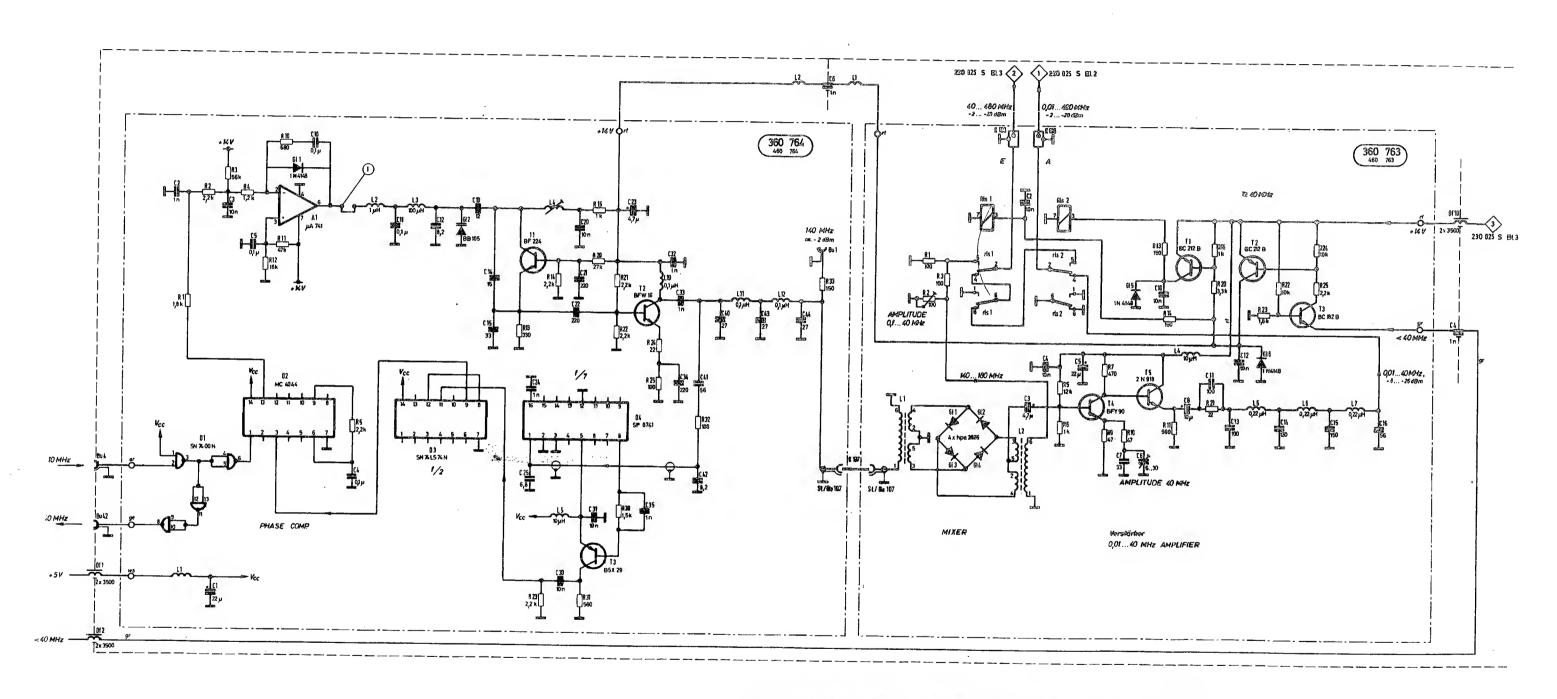
| MEASURED                   |                         |  |  |  |             | ٨             | ۸             | 0                                  |  |              |                          |              |
|----------------------------|-------------------------|--|--|--|-------------|---------------|---------------|------------------------------------|--|--------------|--------------------------|--------------|
| REQUIRED VALUE             |                         |  |  | 1,00 V AC                                    | ₽ 0,93 V AC | 0,971,03 V AC | 0,91,1 V AC   | Distortion < 0,7% (CCITT weighted) | 10 + 01                                  | (Squelch ON) | ·                        |              |
| ADJUST                     |                         |  |  | R 82   | 69 0        | 1 1           | i<br>:        | 1                                  |  | R 18         |                          |              |
| FREQUENCY                  |                         |  |  | f mod = 1 kHz                                | = 20 kHz    | " 1 to 10 kHz | *10 to 20 kHz | fmod = 1 kHz                       |  |              |                          |              |
| MEASURE                    |                         |  |  | 0F 8   |             |               |               | -                                  |  | 0F 8         | ·                        |              |
| PROCEDURE                  | fod Amplifier (360 766) | Calibrate precisely the frequency deviation 20 kHz | at Tmod = 1/70/20 KHz of the signal generator (4000) before the following procedure. | 4000: 2 MHz, 2 V EMF, 0 dB , FM: △f = 20 kHz | ,           |               |               |                                    | Squelch<br>Test assembly as on sheet 577 |              |                          |              |
| REQUIRED TEST<br>EQUIPMENT |                         |  |  |  |             |               |               |                                    |  |              |                          | ·            |
|                            | Adjust                  | mer  | nt ar  |  |             |               | ced           | ure                                |  |              | 4020 series OUTPUT STAGE |              |
|                            |                         | Issue  | Altera   | Alteration No. Date No.                      |             |               |               |                                    |  | OUT OF STAGE |                          |              |
| #Schlu                     | mberge                  | ch.  | -  | 0028   | .29         | 27.           | .3.198        | 0 <b>M</b> or                      | rasch                                    | Replaceme    | 230 025 A                | 7/7<br>Sheet |



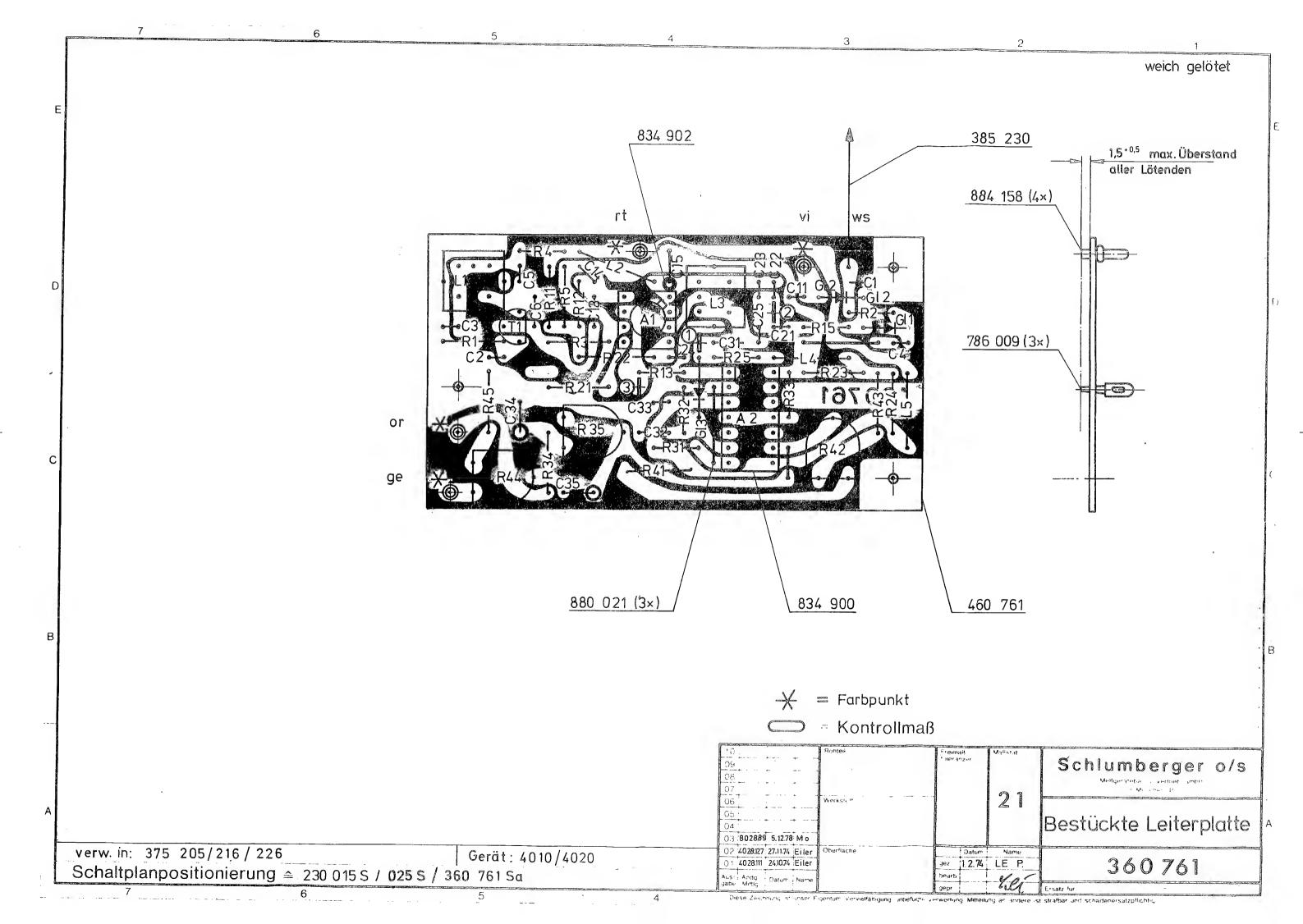
| SW BLACK                | bi BLUE                          |      |                       |               |              | norm, | T         | Van          |                  |               |            |      |
|-------------------------|----------------------------------|------|-----------------------|---------------|--------------|-------|-----------|--------------|------------------|---------------|------------|------|
| or BROWN rt RED rs ROSE | vi VIOLET<br>gr GREY<br>ws WHITE | 03   |                       | 27.7.79       | Eiler        |       | 28.9.78 B |              | Schlumberger n/s | Ausgangsstufe | 230 025 S  | Bl.1 |
| ge YELLOW<br>gn GREEN   | tr TRANSPARENT                   | ISS. | A - Mittlg.<br>MDDIF. | Datum<br>DATE | Name<br>NAME |       | ! !       | Name<br>NAME | 8 München 46     | OUTPUT-STAGE  | Тур : 4020 |      |

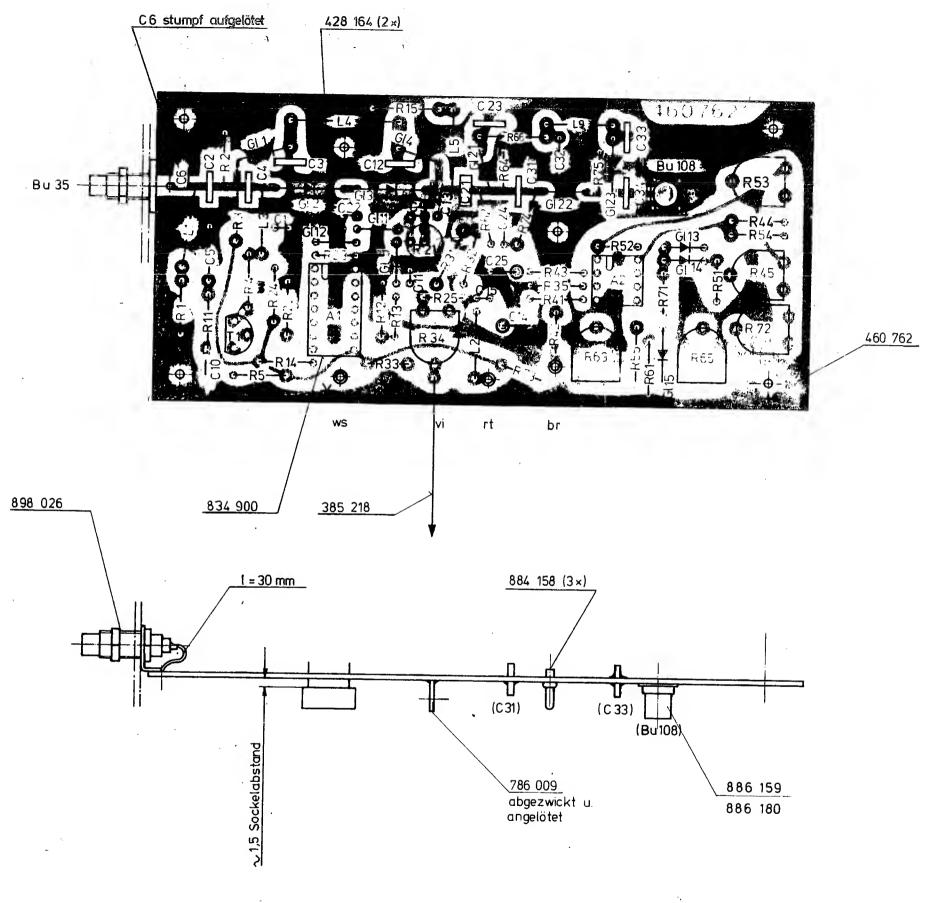






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→ = Farbpunkt

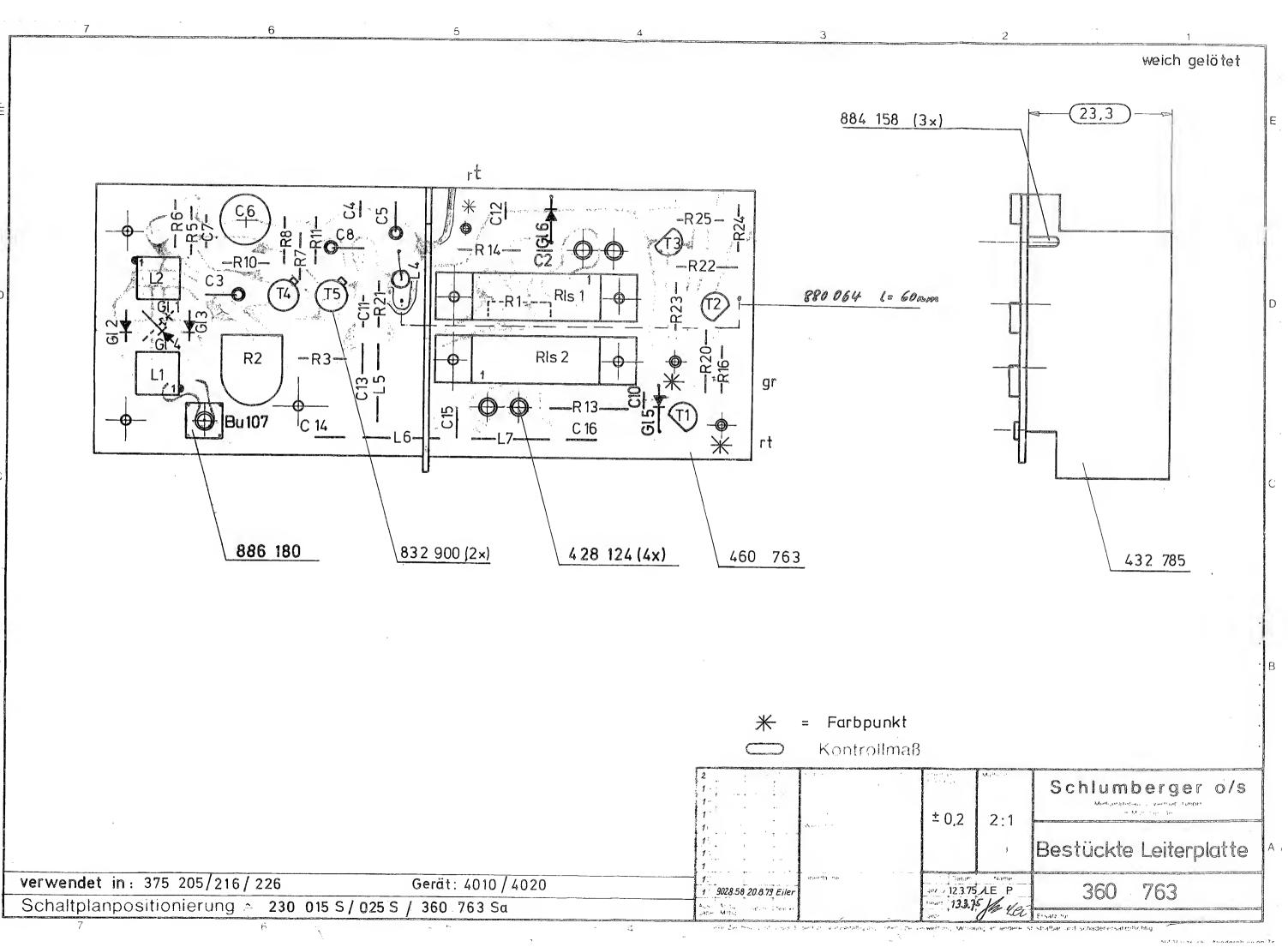
→ Kontrollmaß

| The second secon | A STATE OF THE PARTY OF THE PAR |                     |              |                        |
|--|--|---------------------|--------------|------------------------|
|  |  | Area man            | 2.1          | Schlumberger o/s       |
| 12 9028 50 27779 Eine  |  |                     | <b>4</b> . I | Bestückte Leiterplatte |
| 11 602689 512 78 Mo  | (iberlia ' ,   | э / 311.76<br>bearh | LE P         | 360762                 |

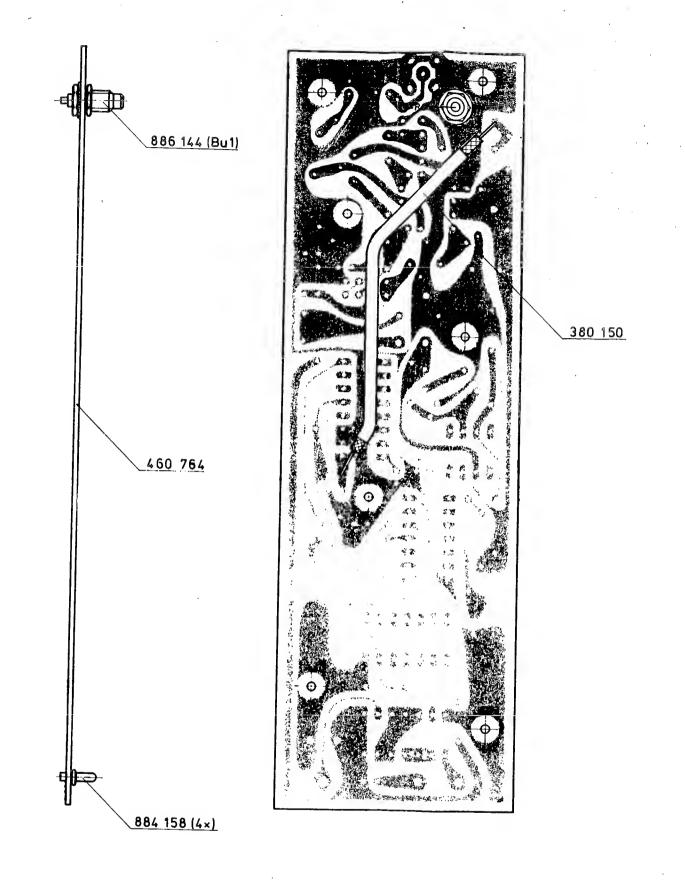
230 025 S
Schaltplanpositionierung = 230 015 S / 360 762 Sa

verwendet in: 375 205/216/226

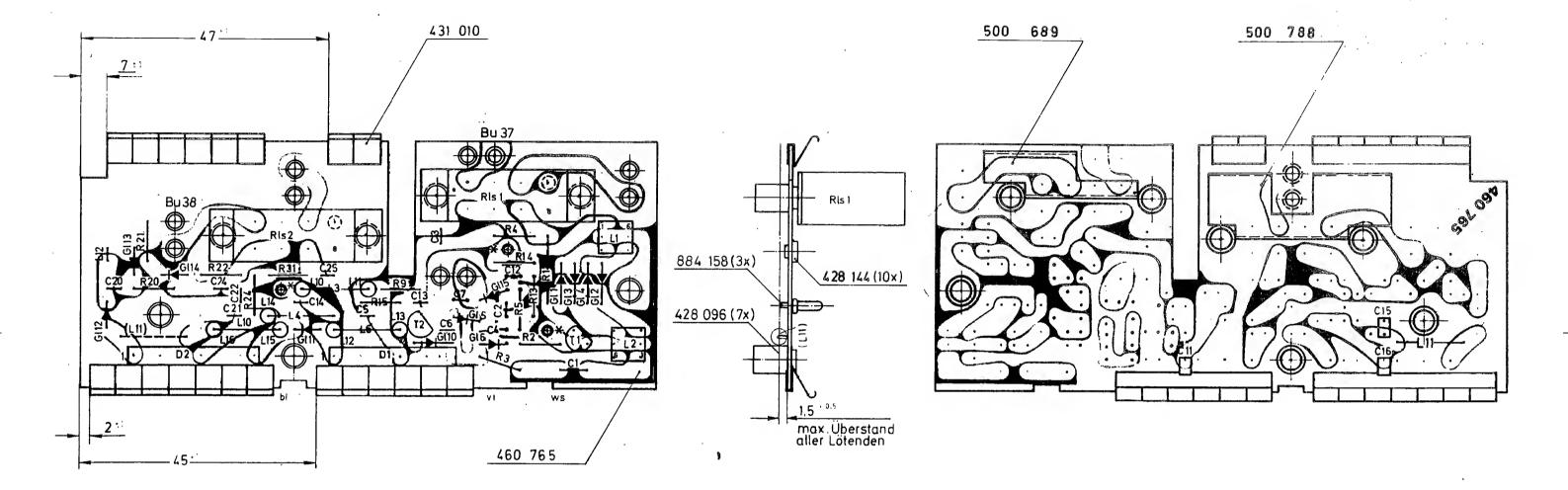
Gerät: 4010/4020



D



| Columb | C



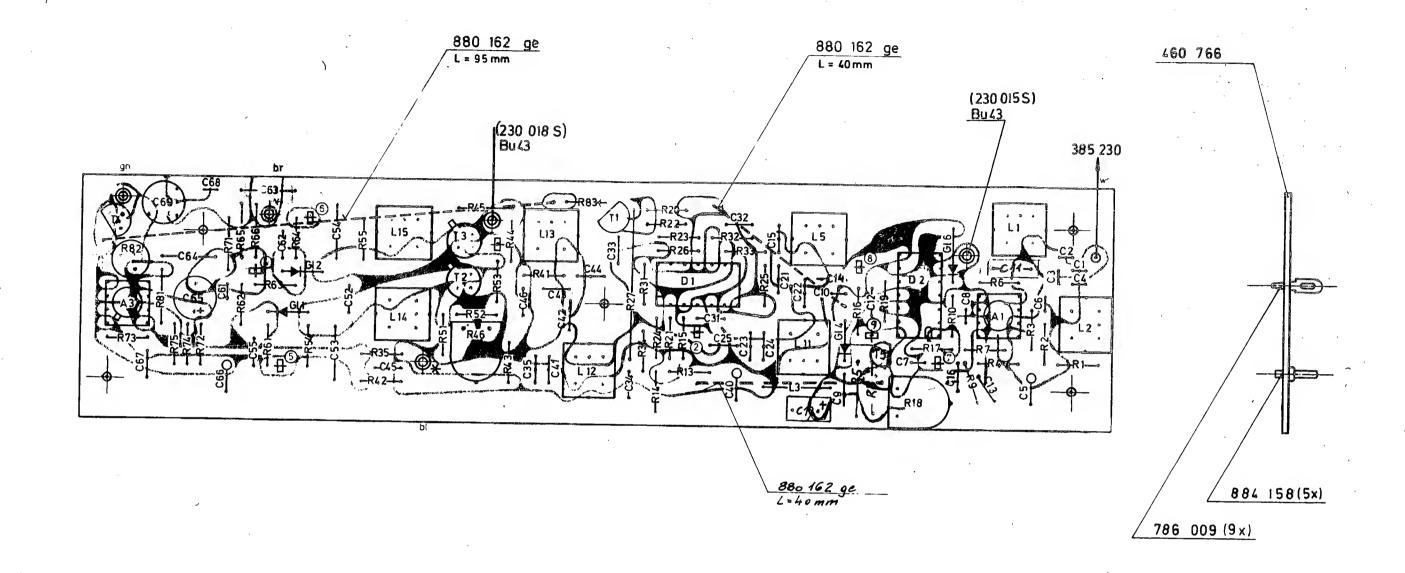
★ = Farbpunkt

| 10 9028 42<br>09 <b>8</b> 028 73     | 26 9 78 | Eiler | · · · | -               |                 | Schlumberger o s       |
|--------------------------------------|---------|-------|-------|-----------------|-----------------|------------------------|
| 08 602647<br>07 5028 37<br>06 502822 | 18 4 75 | Eiler | ±     |                 | 2.1             | Bestückte Leiterplatte |
| 5                                    |         |       | ·     | 25375<br>2.4.7. | EILER<br>Se Kot | 360 765                |

230,025 S 230 018 S ≙ 230 015 S / 360 765 Sa

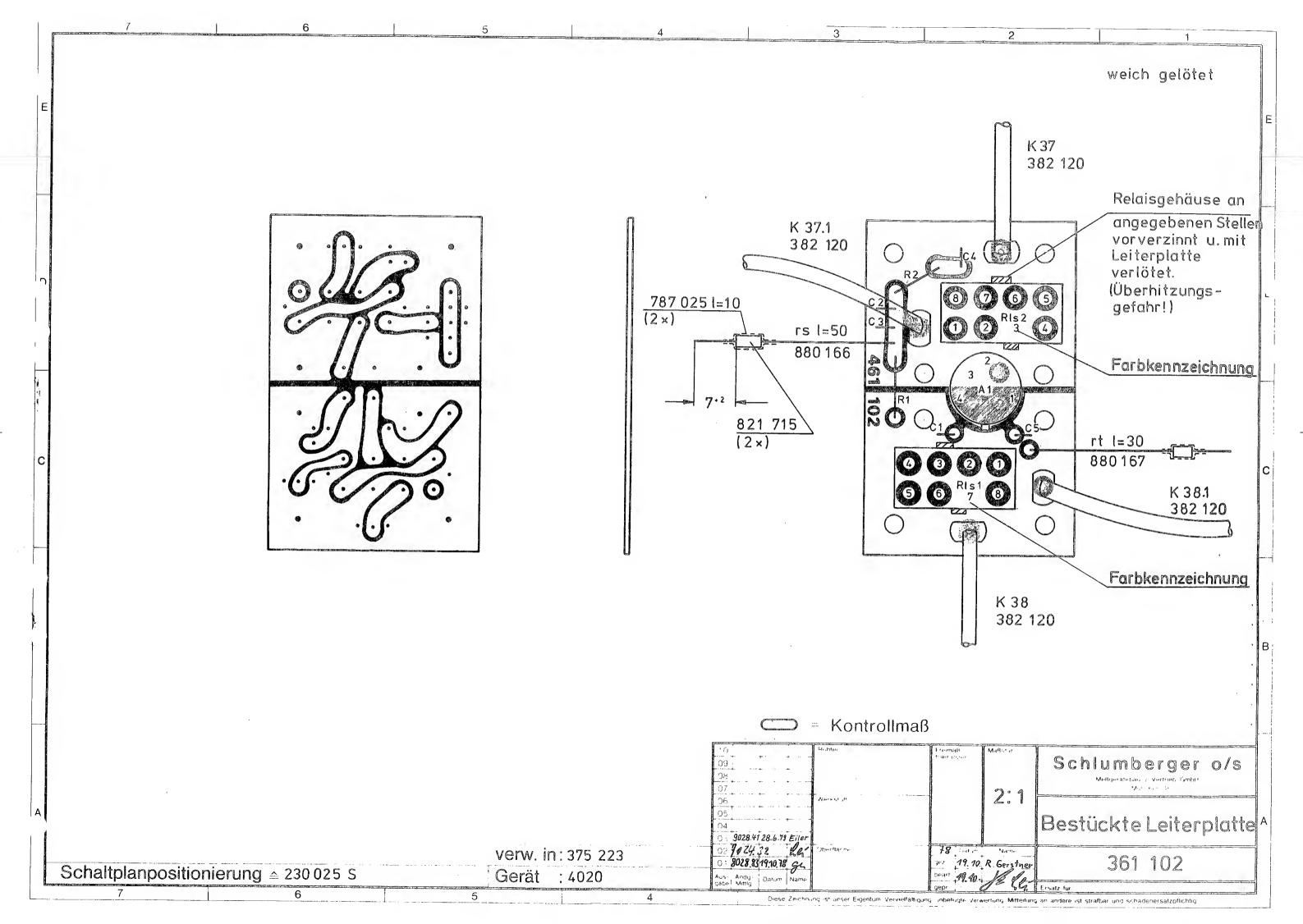
375 226 375 205 : 375 216

4020 / 21/22 4710 A Perat: 4010



230 018 S / 230 024 S 230 018 S / 230 025 S Schaltplanpositionierung 230 015 S / 360 766 Sa

verwendet in 375 216/375 205/225/462 Gerät 4010 / 4710 A / 40 28



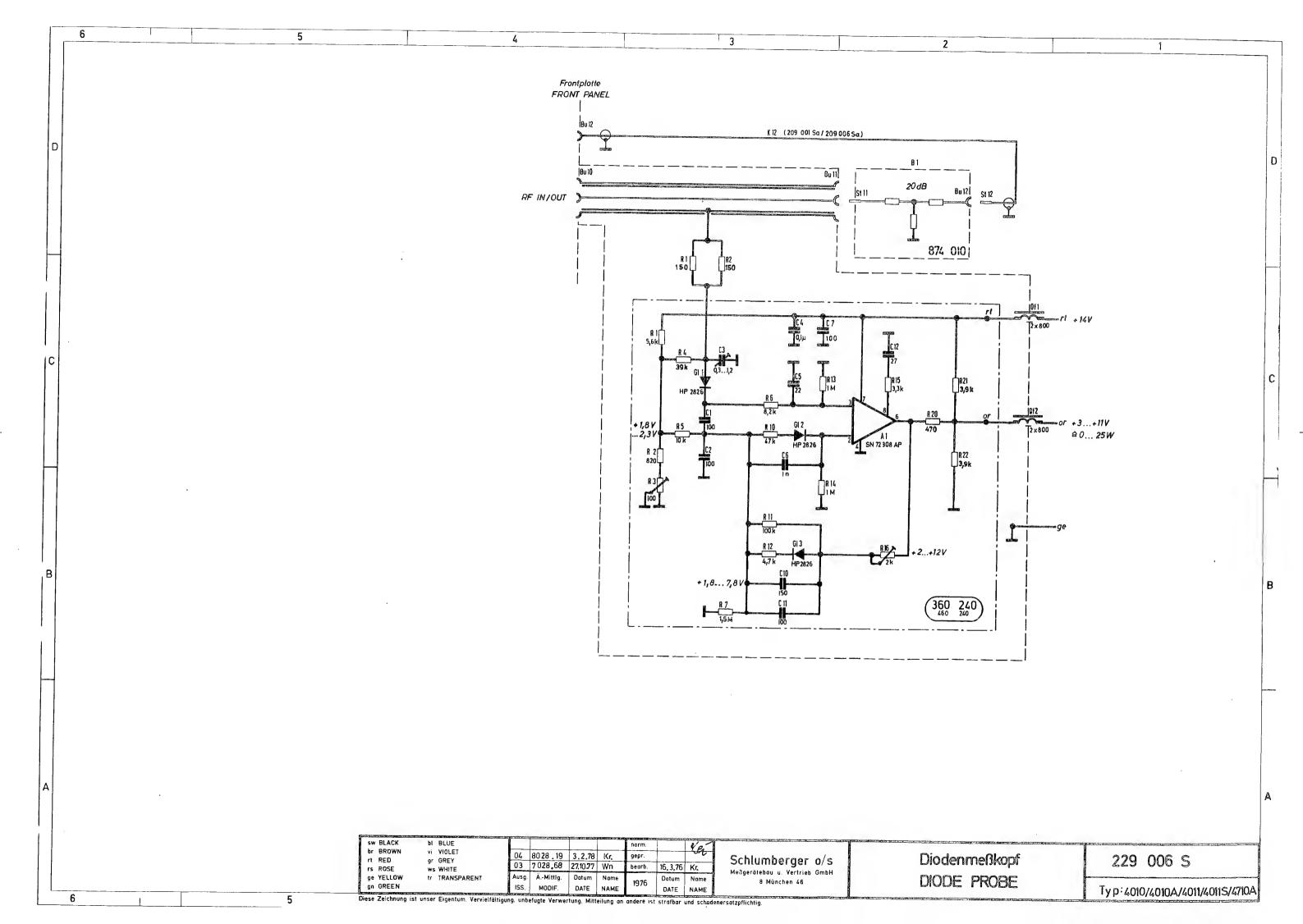
(See block circuit diagram 102 820 B for total instrument)

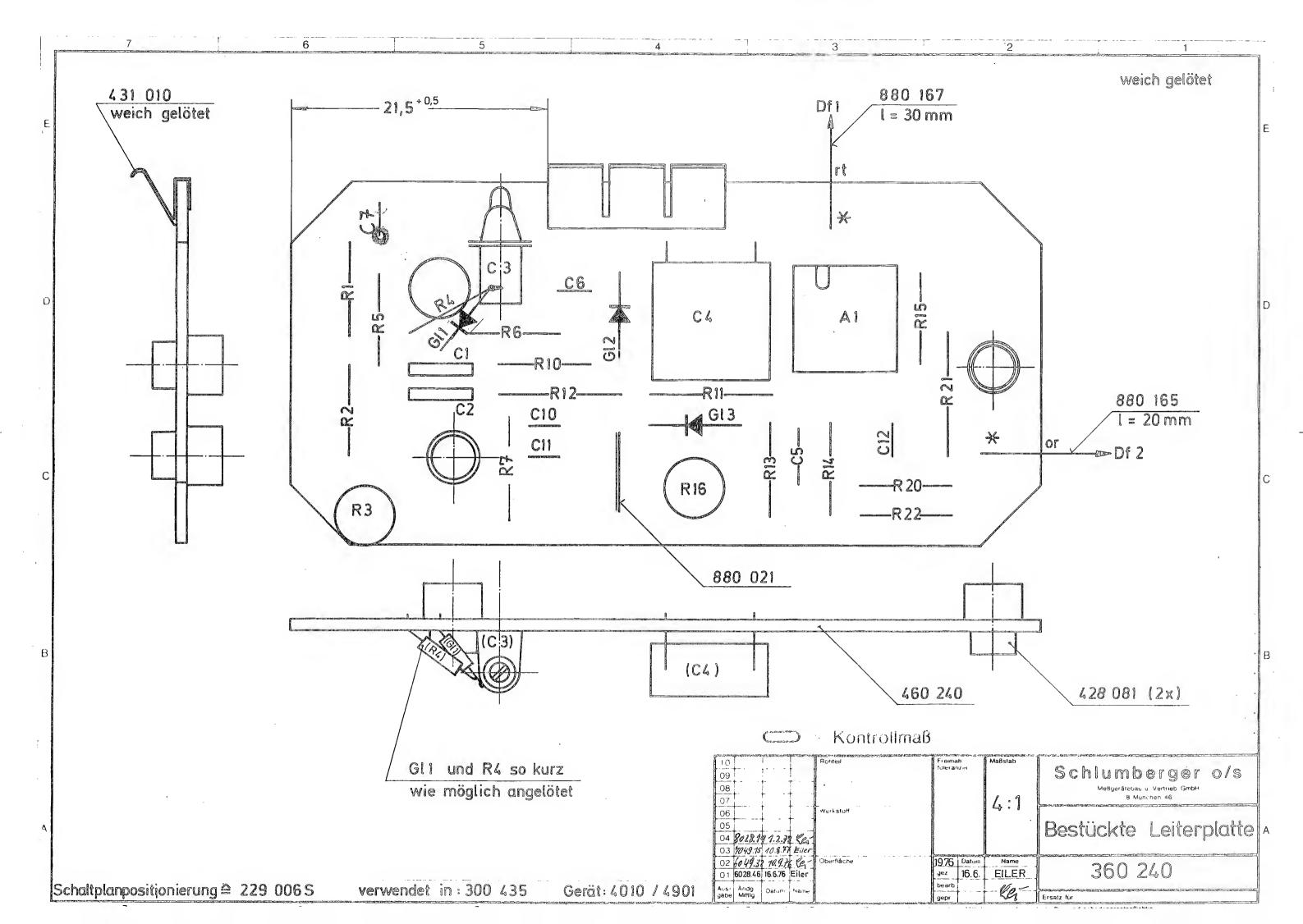
An insulated pipe is inserted into the throughput coaxial to achieve a wide band, low impedance RF decoupling of the low reflection transmitter power to the rectifier diode. The fast rectification (provided by the AF feedback to the input capacity) permits demodulation of amplitude modulated signals. The symetrical design of the amplifier suppresses temperature influences. The level-dependant negative feedback of the output amplifier compensates the lack of linearity of the rectifier diode under small RF level conditions.

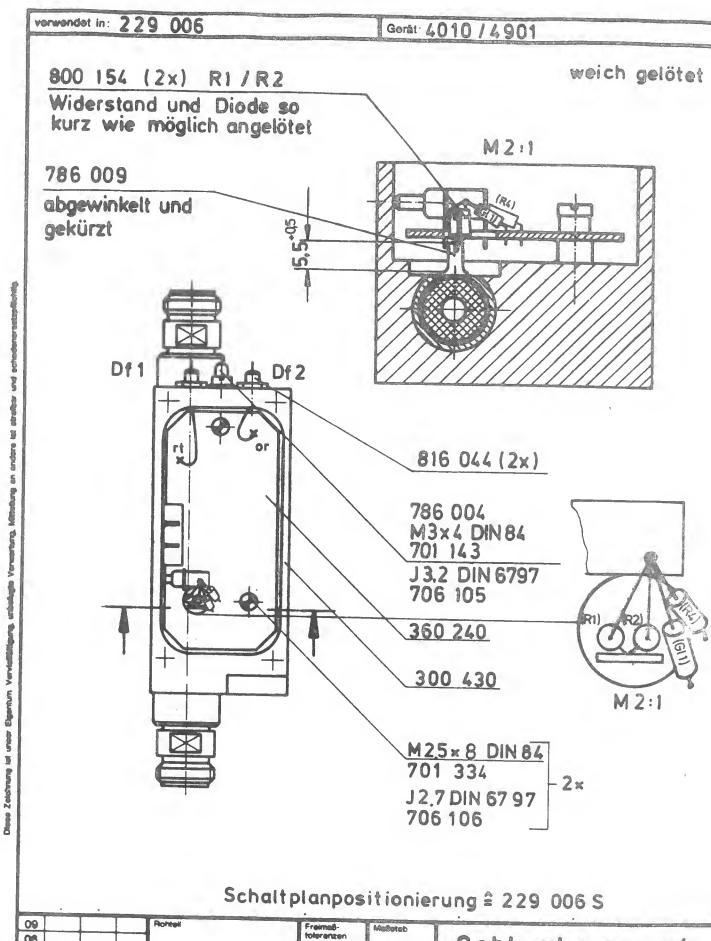
|              | Function Description | 229 006 F   | Sheet 1/1 |
|--------------|----------------------|-------------|-----------|
| Schlumberger | Type: 4020/21/22     | Diode Probe | Date 0979 |

|           | 1                |                        |                                       |  |           |              | 1                                |  |                   |
|-----------|------------------|------------------------|---------------------------------------|--|-----------|--------------|----------------------------------|--|-------------------|
| Sch       | Sah              |                        | REQUIRED TEST<br>EQUIPMENT            | PROCEDURE  | MEASURE   | FREQUENCY    | ADJUST                           | REQUIRED VALUE                             | MEASURED<br>VALUE |
| lumberger | lumberger        | Adjustm                |                                       | <ol> <li>Visual Inspection         Solder joints, screws, coaxial internal conductors etc.         (screw on cover not earlier than 5.)</li> </ol> |           |              | R 3 — centre<br>C 3 — Cmin       | ţ  |                   |
| Kar.      |                  | ner                    |                                       | 2. Reflection measurement  |           |              |                                  |  |                   |
|           | 0.3              | Issue                  | Reflection test                       |  |           | 1001000 MHz  | without test obj.                | VSWR 〈 1,02                                | 1,0dB             |
|           | 90               | Alt                    |                                       |  | D. 10/11  | 100 E00 MU-  | 4+ 5                             | X 0.101                                    |                   |
| _         | 23               | erati                  | termination                           | "Unsuitable for > 500 MHz, 4024, 4025"   | 11 /01 ng | 100 200 MrZ  | termination                      | VSWR                                       | 1,0dB             |
|           | .83_             | on No.                 |                                       |  | Bu 10/11  | 800 960 MHz  | with probe + 50 %<br>termination | VSWR ~                                     | 1,0 dB            |
|           | 24,              | Da                     |                                       | 3. Zero and Linearity at Low Power   |           |              |                                  |  | -                 |
|           | 1.80             | te                     | + 14 V power supply<br>precision DVM  |  | DF 2      | 90           | for R3                           | U max. > +3,02 V<br>U min. < +2,98 V       | + 3 V<br>+ 2,9 V  |
|           |                  |                        |                                       |  |           |              |                                  |  |                   |
|           |                  | me                     |                                       | Caution: If required, only replace Gl 1, Gl2, Gl 3 together  | \         |              |                                  |  |                   |
|           |                  |                        |                                       | (Trio or quartot with Same diode characteristic)   |           |              |                                  |  |                   |
| Replacem  |                  | (4010) <sup>8</sup>    | RF generator e.g. FS 30 or equivalent | G K > 36 d8 probe meter  |           |              | for 1 mW R 3                     | 4 3,050 V                                  | yo .              |
|           | 29 006<br>29 009 | eries<br>49 <b>0</b> 1 |                                       |  |           | for > 3,02 V | 101 C 38                         | Z,98U3,UZU V<br>Note: The difference       | >                 |
|           |                  |                        | meter 335 A also possible)            | DVM  |           | 1,5 MQ       |                                  | to +3 is proportional to the non-linearity |                   |
|           |                  | L 8285                 |                                       | Accuracy requirement of 1 mW level is ± 0.2 dB   |           |              |                                  | up to approx. 10 W                         |                   |
|           |                  | Diode Probe            |                                       | 4. Limiting the LM 308<br>Apply +14 V via 10 kΩ across A 1/pin 3 or 30 W RF  | 0F 2      | οίς          |                                  | U11,311,8 V                                | ۱۱,۰۰۰۰ ۷         |
| Susse     | 1/2<br>Sheet     |                        |                                       | *  |           |              |                                  |  |                   |
|           |                  |                        |                                       |  |           |              |                                  |  |                   |

| MEASURED                   | ~   |                                 | -  |  |  |   |               |
|----------------------------|---|---------------------------------|--|--|--|---|---------------|
| REQUIRED VALUE             | *.  | ∆U — Min.<br>(wideband)         | 20 to 200 MHz<br>△U < 2,5 mV<br>(≏△P = 1%)   | 200 to 500 MHz<br>\DU \(5 mV<br>(\$ \Delta P = 2\%)  | 800 to 960 MHz<br>\alpha V \langle 15 mV<br>(\alpha \text{\alpha P} = 6\boldsymbol{\beta})   |   |               |
| ADJUST                     | RF = approx. 13dBm<br>(=+7 dBm on probe)  | W 395 pot                       | ."   |  | With poor frequency response from 800 to 960 MHz stamp probe:  | 4025" The cause can be in the probe or in the power attenuation pad. Ensure that a sufficient number of combinations result which are also suitable for 960 MHz.  |               |
| FREQUENCY                  | 20 to 960 MHz<br>swept, unmodu-<br>lated, sweep-  | 0.01 sec.                       |  |  | With poor frequency respons<br>800 to 960 MHz stamp probe:<br>*Unswitable for > 500 MHz,   | 4025" The cause can be the power attenua that a sufficient nations result whable for 960 MHz.   |               |
| PROCEDURE                  | 5. RF Response 20 to 960 MHz  power supply  vs.w. < 1.1.  Bu 13.1  Page 13.1 |                                 | probe with original attenuator pad in accordance with later use in instrument.                 | This set-up permits precise comparison of the frequency response of a known probe with an unknown. Absolute calibration is of no use with this small RF level. The absolute deviation independant from frequency is compensated by a potentiometer control in M 395. | The FET chopper provides alternate switching of both outputs at approx. 5 kHz, thus rendering the long-term drift of the complete test set-up unimportant. | Since both probes have the same configuration, faulty measure— ments due to RF distortion, temperature fluctuations, VSWR error etc. The cause can be in the probe or in are commensated by initial approximation. The mechanical balance of both probes to the power splitter (same N-N adapter) is im— portant for measurement accuracy, the requirement being precise that a sufficient number of combination of the reference probe in a special test set-up.  The test set-up can be switched by the push/pull switch on the potentiometer 25 W (pressed) to 50 W (pulled) probe power rating. |               |
| REQUIRED TEST<br>EQUIPMENT | RF sweeper e.g.<br>Wiltron 610 B<br>(freq.limit < 1 dB)   | Oscilloscope<br>Calibration aid | W 395 with integral power splitter (hp 11667 A), 50 a termination (spinned 55 N50-0-11), refe- | rence probe with<br>optimum frequency<br>response special<br>OC chopper  |  | DVM<br>14 V power supply  |               |
|                            | Adjustment and Test Procedure  4020 (4010) series from L 82851 Diode Probe  |                                 |  |  |  |   |               |
| Sch                        | lumberger   | Issue<br>03                     | Alteration No.   | Date 24, 1,80  | Name   | 4901 from L 449<br>229 006 A<br>229 009 A   | 2/2<br> Sheet |
|                            | J.,   |                                 |  |  |  | Replacement for   | Stiest        |







| 09   |                     | Rohtell    | Freime8-<br>tolerengen | Madetab | A STATE OF THE STA |
|------|---------------------|------------|------------------------|---------|--|
| 08   |                     |            | tolerenzen             |         | Schlumberger o/s   |
| 07   |                     |            |                        |         |  |
| 06   |                     |            |                        | 4.4     | Medgerätebeu u. Vertrieb GwbH<br>8 München 46  |
| 06   |                     | Werkstoff  | ±0.2                   |         |  |
| 04   |                     |            |                        |         |  |
| 03   | 8847.2 20.4.78 EHET |            |                        | (M 2:1) | Diodenmeßkopf  |
| 02   | 8028 % 13.2.78 Mo   |            |                        | 3       | Typ:4010 / 4901  |
| 01   | 4028.46 N.678 Eiler | Oberfläche | 2/ Datum               | Nama    |  |
| -    | 5028.2 16.3.76 4 M  |            | 902 30.1.4             | 95 1    | 300 435  |
| Aus- | Andg- Deturn Name   |            | beerb                  | Mar     | 300 433  |

(see block circuit diagram 102820 B for total instrument)

Due to the oscillator frequency, changing as a function of temperature the complete oscillator including the buffer amplifier and the temperature control circuit has to be accommodated in an oven ensuring constant temperature. Especially the crystal must be located thermally as close as possible to the heating transistor T 1 since this is the component most sensitive to temperatures in all the circuitry. The temperature resistances between the heater, sensor, outer wall, and the crystal must be calibrated so that a more or less balanced heat link results as far as this is possible with the relatively high thermal resistance of the crystal.

The NTC resistor R 1 is part of a resistance bridge upstream of a differential amplifier A 1 through which the heating current is controlled through T 1. The heating current is instantly corrected for even a slight change of temperature of R 1 in 360 770 to retrieve the balance of the resistance bridge. T 5 serves to limit the current when heating up (approx. 0.85 A). T 4 disables the heating current should no supply voltage be applied to A 1. T 1 would otherwise draw full current up to thermal death of the circuit.

The output signal of the oscillator is buffered through D 1 so that a change of load at both Bu 3 and Bu 2 influences the oscillator frequency by  $<10^{-9}$ . A back-acting location of phase at the oscillator due to external influences alters the oscillator frequency in inverse proportion to the operational Q of the oscillator.

|              | Function | n Description | 214022 F           | Sheet 1/2 |
|--------------|----------|---------------|--------------------|-----------|
| Schlumberger | Type:    | 4020/21/22    | Crystal Oscillator | Date 0979 |

Coarse tuning (to a few tenths of a Hertz) is carried out by means of trimmer C 12, fine tuning (to a few hundredths of a Hertz) involving a change of varactor voltage (G1 1) is achieved by means of R 1 in 360 767. A change in frequency due to aging can be corrected up to 10 Hz using R 1. If optimum frequency stability is needed, it is recommended never to switch off the oscillator,

since renewed aging always occurs every time operation is interrupted, all the more so, the longer the crystal is out of circuit. In addition, shock and impact are to be avoided. The oscillator can be referenced to an external frequency through Bu 2 as long as this is not more than approx. 7 Hz off the oscillator frequency. In this case, the oscillator crystal acts as a filter.

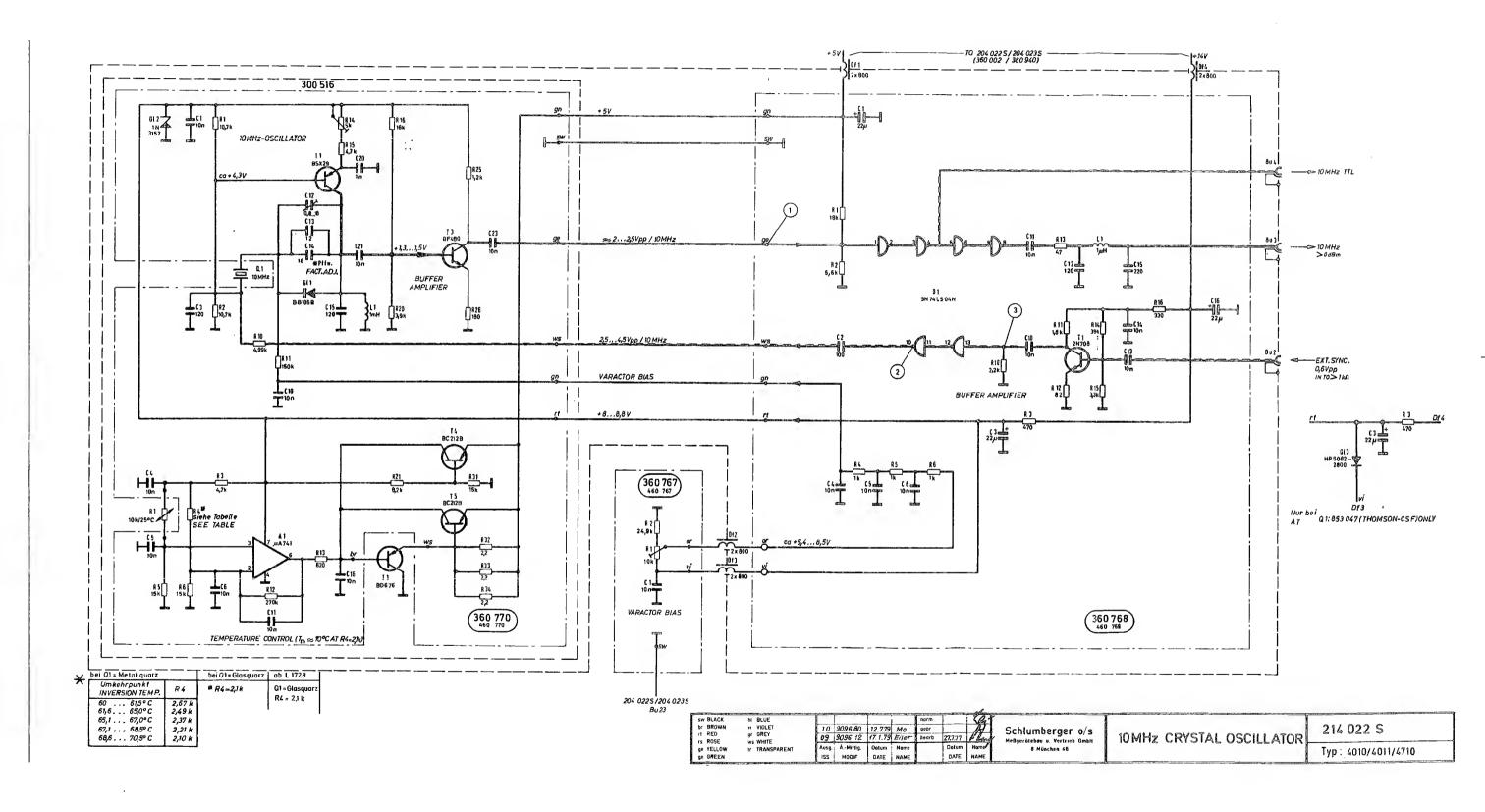
|              | Function Description | 214 022 F          | Sheet 2/2 |
|--------------|----------------------|--------------------|-----------|
| Schlumberger | Type: 4020/21/22     | Crystal Oscillator | Date 0979 |

| cEDURE  ant: between C1 and Df1 d + 14V lead from C16, ad (apply + 14V)  on during the following on during the following with 50.0  with 50.0  with 50.0  ad/C 2  | REGILIBED        | REO! IRE        | REOI IIRE       |                      | TECT              |   |         |              |        |  |                   |
|---|------------------|-----------------|-----------------|----------------------|-------------------|---|---------|--------------|--------|--|-------------------|
| Ear C1 and Df1  W lead from C16, Ammeter DC ——  ply + 14V)  If DC ——  DC coupled to MP 1 approx.10MHz ——  Eier Bu 4 approx.10MHz ——  So.A. Bu 3 approx.10MHz ——  So.A. Bu 3 approx.10MHz ——  CC 2 "   | EQUIPME          | EQUIPME         | EQUIPME         |                      |                   | PROCEDURE   | MEASURE |              | ADJUST | REQUIRED VALUE   | MEASURED<br>VALUE |
| N lead from C16, Purmeter DC ———————————————————————————————————  | 1. Heatin        | -               | -               | •                    | •                 | Heating current<br>Apply ammeter between C1 and Df1 |         |              |        |  |                   |
| " DC  | Ameter           | Ameter          | Ameter          | Discon               | Discon            | red + 14V lead                                      | Ammeter | 8            |        | < 100 mA   |                   |
| ring the following  ring the following    MP 1   approx.10MHz   R 14  |                  | t ar            |                 | apply .<br>Insert    | apply .<br>Insert | r = 5V $red lead (amoly + 14V)$                     | =       | }            |        |  |                   |
| ring the following  DC coupled to  R16/R20 approx.10MHz  Eier  Bu 4 approx.10MHz  50.0  Bu 3 approx.10MHz  coss Bu 2  C10/R10 10 MHz  C 2 "  C 2 "  | nd               | nd              |                 |                      |                   |   |         | 3            |        | 800mA1000mA  | -                 |
| DC coupled to MP 1 approx.10MHz R 14  Eier R16/R20 approx.10MHz  Bu 4 approx.10MHz  Bu 3 approx.10MHz  Coss Bu 2 C10/R10 10 MHz  Cc 2 "  Cc 2 "   |                  | Tes             |                 | Leave a              | Leave a           | the   |         |              |        |  |                   |
| DC coupled to       MP 1       DC         R16/R20       approx.10MHz       ———         S0.Ω       Bu 4       approx.10MHz       ———         amplifier       C10/R10       10 MHz       ———         coss Bu 2       C10/R10       10 MHz       ———         c 2       "       ——— | t F              | t F             |                 |                      | measure           | nents:  |         |              |        |  |                   |
| DC coupled to MP 1 DC  R16/R20 approx.10MHz  Bu 4 approx.10MHz  Bu 3 approx.10MHz  C10/R10 10 MHz  C2 "  C2 "   | 0                | Oscilloscope 2. | Oscilloscope 2. | 2.                   |                   | Jol   |         |              |        |  |                   |
| Eier R16/R20 approx.10MHz Bu 4 approx.10MHz Bu 3 approx.10MHz C10/R10 10 MHz C2 " C2 "  | cedure           |                 |                 |                      |                   |   |         | approx.10MHz | R 14   | 2.5.Vp-p (min.<br>2 Vp-p)                                    |                   |
| ### Bu 4 approx.10MHz  50.7  Bu 3 approx.10MHz  amplifier  coss Bu 2  C 2 "  C 2 "  |                  | e               |                 | Set oscil<br>D1/Pin1 | Set oscil         | \$<br>\$  | MP 1    | 8            |        | \{\text{Valley < +0.5 V}\}\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ |                   |
| Eier  Bu 4 approx.10MHz  50.0  Bu 3 approx.10MHz  amplifier  coss Bu 2  C 2 "  C 2 "  |                  |                 |                 |                      |                   |   | R16/R20 | approx.10MHz | -      | 200 0 9 0  |                   |
| 50.A. Bu 4 approx.10MHz amplifier coss Bu 2 C 2 "  C 2 "  | 3. Output buffer | ř.              |                 |                      |                   |   |         |              |        | d.d.   |                   |
| 50.02  Bu 3 approx.10MHz  coss Bu 2  C 2 "  C 2 "   |                  |                 |                 |                      |                   |   | Bu 4    | approx.10MHz |        | TIT  |                   |
| amplifier  Coss Bu 2  C10/R10 10 MHz  C 2 "  C 2 "  | N Terminate      |                 | Terminate       | Terminate            | Terminate         | 图   | Bu 3    | approx.10MHz |        | 0.81.5Vp-p   |                   |
| 2 C 2 " C 2 " ———   | 4020             | 4020            | 4.              |                      |                   | zer buffer amplifier                                |         |              |        |  |                   |
| 2 C 2   | 10 MHz;          | 10 MHz;         | 10 MHz;         |                      |                   | V <sub>p-p</sub> ac                                 | C10/R10 | 10 MHz       |        | Valley <+0.5 V   |                   |
| (amplitude shiver can be ignored)   | Test at whi      | series          | Test            | Test at whi          | Test at whi       |   |         | E            |        |  |                   |
|   |                  |                 |                 |                      |                   |   |         |              |        | (amplitude shiver  | L.                |
|   |                  |                 |                 |                      |                   |   |         |              |        |  |                   |

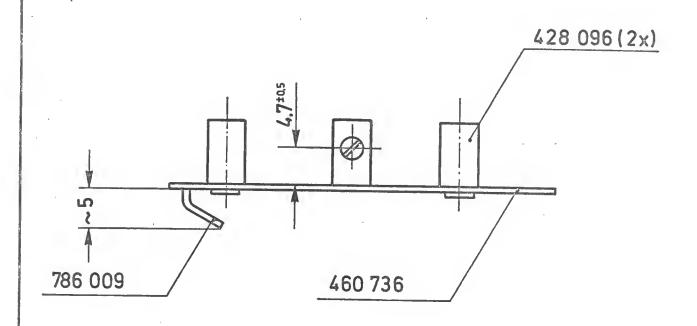
| MEASURED<br>VALUE          | •   |   |                         |              |
|----------------------------|---|---|-------------------------|--------------|
| REQUIRED VALUE             | <b>∆</b> V > 2 V betweer<br>>+5.6 and +8.8V   | 750 mA  | Δf > 40 Hz              |              |
| ADJUST                     |   |   | C 12                    |              |
| FREQUENCY                  | 8   | 8   | 10 MHz + Af             |              |
| MEASURE                    | D£ 2  | Ameter  | Bu 3                    |              |
| PROCEDURE                  | 5. Varactor voltage Turn R1 from stop to stop | 6. Checking heating current Heating current must be < 750 mA after 6 minutes.running.  7. Fine tuning frequency Synchronize a 10MHz synthesizer (1Hz resolution) with a standard frequency (stability better than 10 <sup>-8</sup> ). Use synthesizer output signal to externally trigger the oscilloscope. Connect oscilloscope to Bu 3 Fully turn up trimmer C 12 as for as it will go. Offset the synthesizer until the scope display freezes. | fsynth10 MHz -> 40 = Af |              |
| REQUIRED TEST<br>EQUIPMENT | DVM.  | Ammeter  Standard, os- cilloscope, synthesizer  |                         |              |
|                            | Adjustmer                                     | t and Test Procedure ' 4020 (4010) series  10 MHz Crystal Oscil   | lator                   |              |
| Schl                       | umberger                                      |   |                         | 2/4<br>Sheet |

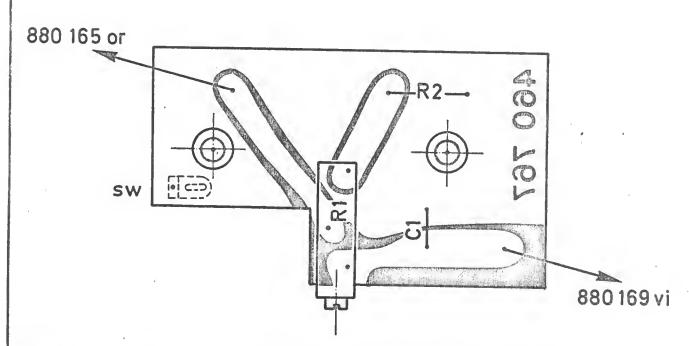
|          |                    |                            |   |                  |                    | *      |                |                   |
|----------|--------------------|----------------------------|---|------------------|--------------------|--------|----------------|-------------------|
| Schl     |                    | REQUIRED TEST<br>EQUIPMENT | PROCEDURE   | MEASURE<br>POINT | FREQUENCY          | ADJUST | REQUIRED VALUE | MEASURED<br>VALUE |
| lumbe    | Adjı               |                            | <i>4</i> ,  |                  |                    |        |                |                   |
| erge     | ust                |                            | Return C 12 as far as it will go and  |                  |                    |        |                |                   |
| er       | me                 |                            | offset synthesizer to again freeze: the   | ٠                |                    |        |                |                   |
|          | ent                |                            | oscilloscope display.   |                  |                    |        |                |                   |
| Sue      | an                 |                            | 10 MHz - $f_{\text{synth}}$ 40 Hz = $\Delta f$  | Bu 3             | 10MHz − Δf         | C 12   | △f > 40 Hz     |                   |
|          |                    |                            | Return synthesizer to precisely 10MHz   |                  |                    |        |                |                   |
| nation   |                    |                            | and more or less freeze the display   |                  |                    |        |                |                   |
| -        |                    |                            | using C12.  |                  | 10MHz ±Δf          | C 12   | Δf 0           |                   |
| -        | -                  |                            | R 1 to anti-clockwise stop  |                  | $10MHz - \Delta f$ | R 1    | Δf > 8 Hz      |                   |
| Date     |                    | •                          | R 1 to clockwise stop   | :                | 10MHz +∆f          | R 1    | Δf > 8 Hz      | ***               |
| 77       |                    |                            | Set R 1 to freeze display   | 2                | 10MHz ±∆f          | R 1    | Δf <b>↓</b> 0  |                   |
| Krban    |                    |                            | If tuning range can not be established, change C 14 (tubular C). Reference value: approx. 1 pF/10Hz |                  | · · · · · ·        |        |                |                   |
| $\dashv$ |                    |                            | 8. Synch. test  | MP 2             | 8                  |        | < + 0.4 V      |                   |
| 214 0    |                    | DVM                        | Apply synthesizer through distributor to Bu 2 and ext.  |                  |                    |        |                |                   |
| 22       |                    |                            | Apply scope trigger input   |                  |                    |        |                |                   |
| A        | (4010<br>ryst      |                            | Apply 10MHz less 7 Hz to Bu 2/0.6 V   | 200              | 10 MHz -           |        | Display mist   |                   |
|          |                    |                            | 4   |                  | 7 Hz               |        | freeze (no     |                   |
|          | es<br><b>scill</b> |                            | To test, reduce frequency until display rolls.  |                  |                    |        | SITIVEL        |                   |
|          | ator               |                            | Apply 10MHz + 7 Hz to Bu 2/0.6 Vp-p   | Bu 3             | 10 MHz +           |        | ~              |                   |
|          | •                  |                            | By way of test, increase frequency until display rolls.   |                  |                    |        | shiver)        |                   |
| /4       |                    |                            |   |                  |                    |        |                |                   |

|   | MEASURED                   |   |  |               |                              |  |                                |                                      | ,                                   |                           |   |                                 |   |  |                    |                |                                      |                                       |  |                                      |
|---|----------------------------|---|--|---------------|------------------------------|--|--------------------------------|--------------------------------------|-------------------------------------|---------------------------|---|---------------------------------|---|--|--------------------|----------------|--------------------------------------|---------------------------------------|--|--------------------------------------|
|   | REQUIRED VALUE             |   | 730C ± 4°C<br>670C ± 4°C                                     | )<br> -<br> - |                              |  |                                |                                      |                                     |                           |   | Transient                       | frequency peaks                         | <= 4.10=9                              |                    |                | TR / 15.10+8/10 v                    | Aging < -5.10-9/                      | 10 MHz                                 | accuracy ±3,10+8                     |
| , | ADJUST                     |   |  |               |                              |  |                                |                                      |                                     |                           |   | مدادا فو موادر المراجع المراجعة |   |  |                    |                |                                      |                                       | C 12                                   |                                      |
|   | FREQUENCY                  |   |  |               |                              |  |                                |                                      |                                     |                           | -   |                                 |   |  |                    |                | فالتراجية المالية المالية            |                                       | 10 MHz                                 |                                      |
|   | MEASURE                    |   | (T 1)  | :             |                              |  |                                |                                      |                                     |                           |   | Bu 3                            |   |  |                    |                | Bu 3                                 |                                       | Bu 3                                   |                                      |
|   | PROCEDURE                  | 9. Over temperature<br>Apply temperature sensor directly<br>alongside T 1 on mounting plate | At R 4 = 2 $^{\circ}$ K $\Omega$<br>At R 4 = 2.49 k $\Omega$ | ssemb]        | der the supply leads an note | The chassis<br>Apply 8 weeks minimum aging time. | 11. Medium frequency stability | Apply voltage to test set up and the | corresponding test object through a | mains voltage stabilizer. | Plot for 1 hour in range $10^{-8}$ /cm at | 10 min/cm chart speed.          | Take a 10% sample from production batch | for a frequency stability record over- | night (20 min/cm). | 12. Final Test | Plot temperature coefficient against | $\Delta$ T = 40°C in oven or cabinet. | 13. After 3 hours turn-on time at room | temperature turn R 1 to mid position |
|   | REQUIRED TEST<br>EQUIPMENT | Temperature<br>gauge  |  |               |                              |  |                                | Frequency<br>Difference              | Meter (Tracor)                      | and wy Bosons             | Jangoow IV                                |                                 |   |  |                    |                | · -                                  |                                       | 23                                     |                                      |
|   |                            | Adjustmer   |  |               |                              |  |                                | _                                    |                                     |                           |   | 10 N                            |   |  |                    | ) ser          |                                      | llat                                  | or                                     |                                      |
|   | Schl                       | umberger  | issue 01   |               | on No.                       | 8 . A.   | 75                             | Nar<br>X                             | _                                   |                           | Penla                                     |                                 |   | 214                                    | 022                | ? A            |                                      |                                       |  | 4/4<br>Sheet                         |



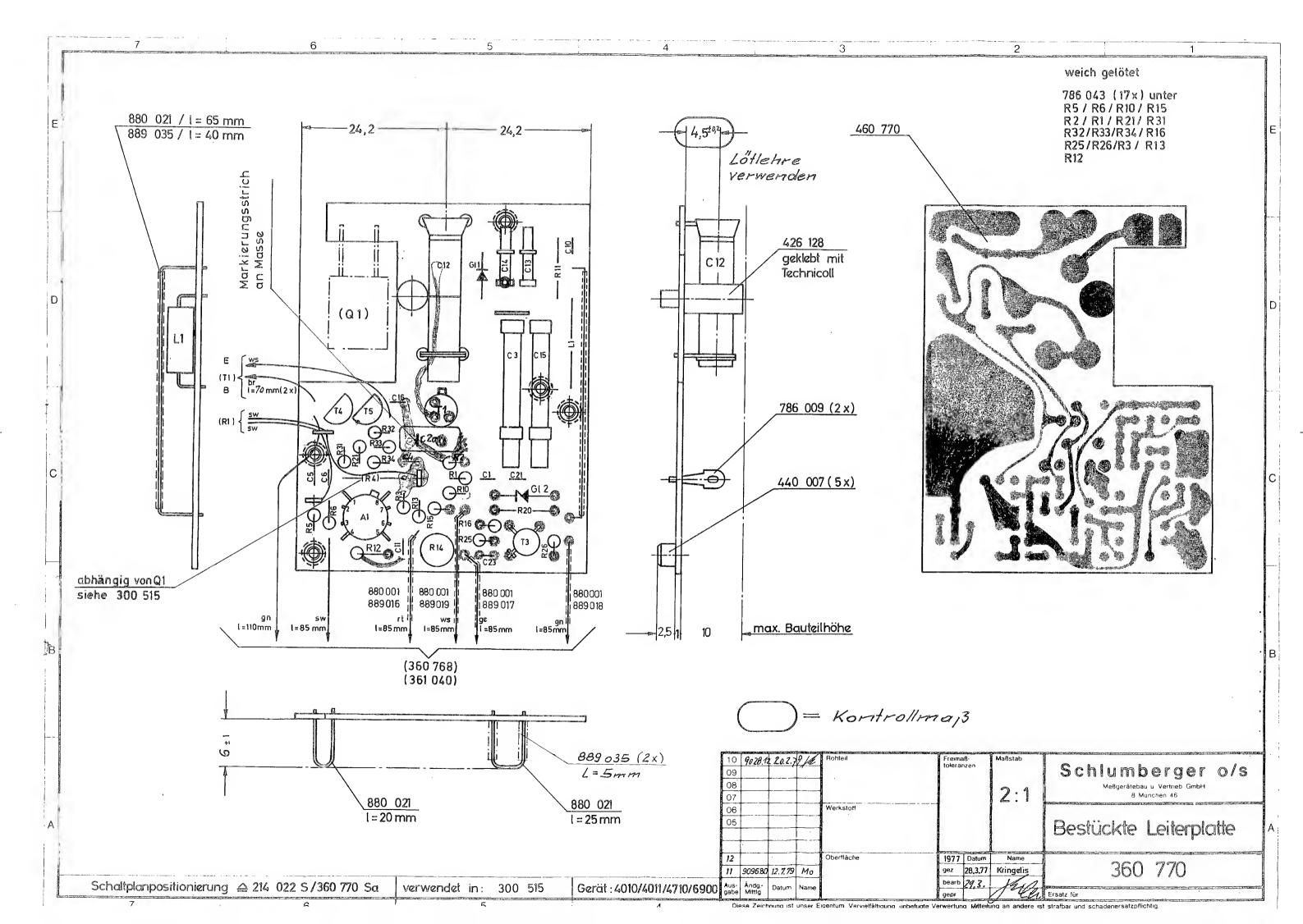
weich gelötet





Schaltplanpositionierung ≥ 214 022 Sa/360 767 Sa

| 0000 | 8<br>7<br>6 |          | Pohtes       | Frein-<br>tolera       |                 | Maßsrah | Schlumberger o/s       |
|------|-------------|----------|--------------|------------------------|-----------------|---------|------------------------|
| 0:   | 3           |          | Werk Stuff   | ×                      |                 |         | Bestückte Leiterplatte |
|      | 1 9028.     | 12.12.7: | Otierfla: ne | 1979<br>de 2<br>treast | Datum<br>12.12. | EILER   | 360 767                |



(See block circuit diagram 102 820 B for total instrument)

On AC power supply 4 primary windings of the mains transformer are connected to a voltage selector switch in accordance with the incoming mains voltage. The secondary voltages are rectified and stabilized by conventional means, current limiting being of the "fold back" type with heavily reduced maximum current under short circuit conditions. The unstabilized +8 V voltage serves to supply the external channel selector. The fusible wiresafeguard is located in the decade stage.

On external 12 V battery operation the battery voltage is made use of through a buffer diode directly as the upper voltage of the +5 V control circuit. For the +14 V control circuit the battery voltage is first of all elevated accordingly by means of a DC/DC concerter. A resonant chopper circuit permits conversion of the battery voltage. An additional protective circuit ensures that the chopper transistors are not ruined by short circuit or non-oscillatory conditions.

|              | Function Description | 204022 F     | Sheet 1/1 |  |
|--------------|----------------------|--------------|-----------|--|
| Schlumberger | Type: 4020/21/22     | Power Supply | Date 0979 |  |

|   | MEASURED<br>VALUE          |   |  | mA  |             | \<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\<br>\ | AL.  |                                      |  |                        | SC                         | < <                               |       |
|---|----------------------------|---|--|---|-------------|---|--|--------------------------------------|--|------------------------|----------------------------|-----------------------------------|-------|
|   | REQUIRED VALUE             |   |  | Current consumption 220 290 mA from 0 to + 14 V | + 14,02 V   | 8 9 V<br>V < 20 mV DC<br>V < 20 mV DC   | $V_{AF}$ < 200 $\mu\nu$ mms $V_{AF}$ < 50 $\mu\nu$ mms |                                      | Maximum available                      | Short circuit current: | Maximum current            | Short circuit currents 0,3 0,85 A |       |
|   | ADJUST                     |   |  |   | # 23        |   |  |                                      | R load                                 | R load = 0 n           | R load                     | R load = 0 a                      |       |
|   | FREQUENCY                  |   |  |   |             |   | Kipple (100 Hz)  |                                      |  |                        |                            |                                   |       |
|   | MEASURE                    | 1)  |  | Bu 8<br>Bu 23/81                                | /83         | . A10   | 88 / B   |                                      | 8u 23/81                               | =                      | Bu 23/ BB                  | =                                 |       |
|   | PROCEDURE                  | Crystal Stage (214 022) disconnected. Mains switch adapter or short circuit termination HNK 898 033 connected to Bu 8 (see 209 021 (209 001) S 81. Dummy Loads (+5 V: 2,2 a/11 N = 2,27 A and | S) and Sensor (8u ns 8/9).                                   | variable transformer slowly from 0 to 242 V     | s to 220    | 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8   |  | Current Limiting                     | adjustable load 014 a to + 14 V output |                        | w 0 2, 2 n to + 5 V output |                                   |       |
| : | REQUIRED TEST<br>EQUIPMENT | Adapter with mains switch, or short circuit termination   | Dumny Loads Voltmeter Amperemeter Variable mains transformer | ;   | ,           | AF Analyser   |  |                                      |  |                        |                            |                                   |       |
|   |                            |   | Issue Alteration 04 8028.44                                  | No. D   | ate<br>4.78 | Name X  |  | 4020 (40°<br>POWER SUPPLY<br>204 022 | 10) se                                 | ries                   |                            |                                   | 1/2   |
|   | Schlumberger               |   | OF 0000 F0   |   | 10.79       | Marroch   |  |                                      |  |                        |                            |                                   | Sheet |

|   | MEASURED                   |  |  |                         |   | Au  | Att.   | V.   |  |   |          |   |           |
|---|----------------------------|--|--|-------------------------|---|---|--|--|--|---|----------|---|-----------|
|   | REQUIRED VALUE             |  | V 6 + 8 +  |                         |   | + 14 V/&V < 20 mV   | + 5 V/AV < 30 mV   | + 4,0 4,7 A  | + 14 V                                     |   |          |   |           |
| * | ADJUST                     |  |  |                         |   |   |  |  |  |   |          |   |           |
|   | FREQUENCY                  |  |  |                         |   | 1   |  |  |  |   |          |   |           |
|   | MEASURE                    |  | Bu 23/A10  |                         |   | Bu 23/81  | 80 23/ 88  | St 2 /Power  | 8u 23/-81                                  |   |          |   |           |
|   | PROCEDURE                  | Mains Selector  Before changing Mains Selector position, mains must be switched off. | Variable transformer and Mains Selector<br>to 230 V<br>110 V | 240 V<br>120 V<br>130 V | Switch mains selector to the required position. | DC - DC - Converier Switch off mains + 10,815,6 V to St 2 | Current consumption hereby (V <sub>batt</sub> , = 12 V) (without crystal oscillator) | Set load current axactly to 2,27 A at 5 V and simultaneously to 1 A at 14 V. | Check start condition of the DC-converter: | (Note: DC-Converter does not start oscillating, when the mains voltage is increased slowly) |          |   |           |
|   | REQUIRED TEST<br>EQUIPMENT |  | . 0  | i                       | ſ   | 6 A - Power Supply  |  |  |  |   |          | 1 |           |
|   |                            | Adjustment and Test Procedure  |  |                         |   |   |  |  | . 40                                       | 20 (4010  | ) series |   |           |
|   | Schl                       | umberger   | 0.3<br>02  | 8028.44<br>6028.51      |   | Date<br>8.10.73<br>1.4.78<br>1.7.76                       | Name  Harmy  U  Kr.  | PI   |  | 022 A   |          |   | /2<br>eet |

